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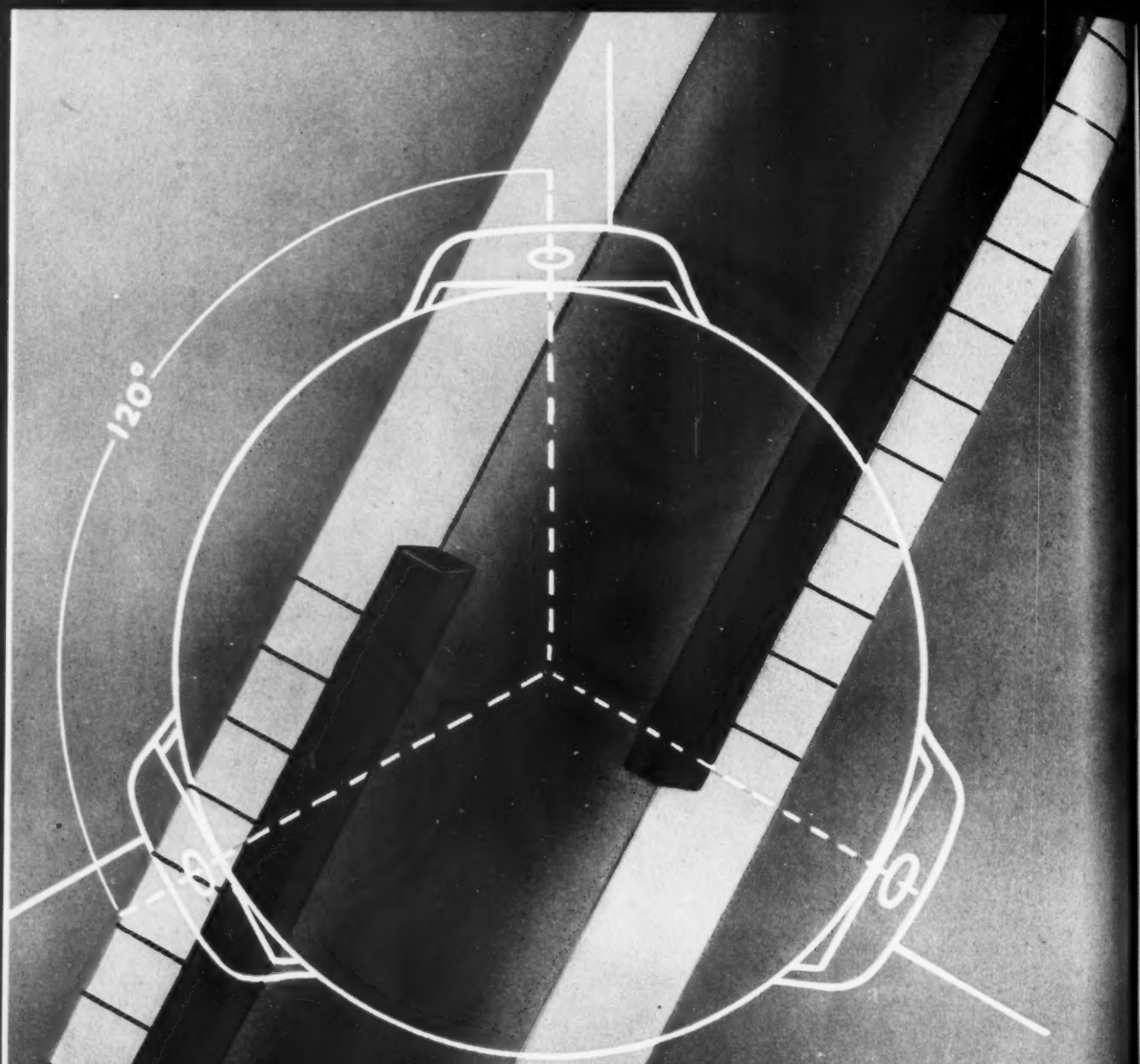

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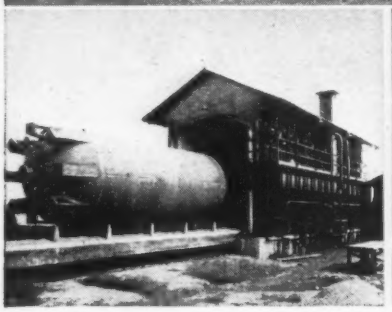

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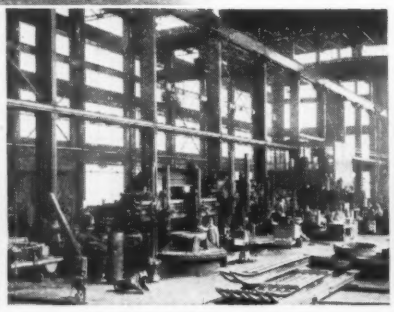

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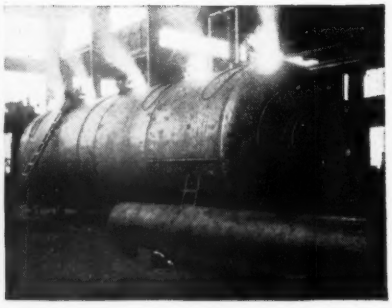

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Keeping a Promise

NEARLY a year ago this page said, "Something will have to be done with the big-inch pipe lines." It was contended that those who believed that the 24 and 20-inch war lines extending from Texas to the Atlantic seaboard would not become a major issue in peacetime oil operations were "indulging in wishful thinking." It was hoped then that a quick decision could be made as to operation or a permanent shutdown.

Now, after 15 months, the lines as regards disposal are about where they were when they were shut down following V-J Day. In the meantime so much has appeared in the press and on the air that the lines have become the most discussed war property, and their future is now more a matter of public policy than industrial utilization. The man in the street knows about the "big inch" and the "little big inch." At the moment the lines are being suggested as a club in the settlement of a coal strike, a program which would have had more weight had it been conceived and made effective by converting the arteries to natural-gas transportation months ago.

In the confusion of recent weeks, culminating in the rejection of all bids by the War Assets Administration, the promises made in the early history of the lines appear to have been forgotten at Washington. The operation of the 24-inch was made possible because companies with refineries on the Atlantic seaboard pooled their production and transportation facilities in Texas, thus supplying crude oil at one end of the line and plant outlets at the other end. Later, largely the same group of companies worked together in the operation of the 20-inch product line.

The peacetime significance of these lines was appreciated at the time they were built and responsible government officials in Washington gave assurance that they would not be operated after the emergency to disrupt the sound production, refining, transportation, and distribution operations that had been established in the Middle West and East by private companies previous to the war. This obligation to operators who carried a heavy load during the war will be ignored should the Government, on the ground of national safety or some other pretext, approve suggested plans for big-inch operations which would result in unfair competition.

There are those who contend that too much emphasis is being placed on the possible emergency use of the lines in the future. They feel that it will be difficult, if not impossible, to work out a program for the use of the lines, either for natural gas or petroleum liquids, which assumes that the lines will be taken over by the military at the start of an emergency. This procedure would solve one shortage by creating another.

Protection for this country, petroleumwise, in the future as in the past, lies in the normal expansion of a free industry and not in circumscribing private activities in anticipation of future developments which never materialize as projected.

Big-Inch to Go Into Service During Coal Strike, Krug Says

by Henry D. Ralph

WASHINGTON.—The Government's big-inch pipe lines will be converted to natural gas immediately as an emergency measure to alleviate the fuel shortage in the Appalachian region this winter, Secretary of the Interior J. A. Krug told the House surplus property committee Monday.

Tennessee Gas & Transmission Co. will be given a 4-month lease by War Assets Administration and a temporary certificate by the Federal Power Commission and will use both big-inch lines as an auxiliary to its present system, with the gas being allocated among distributing companies as directed by the Government under emergency orders.

Krug said this decision was reached following several days of conferences in the Interior Department and formal requests to take this action went to WAA and FPC Monday morning. The secretary told the committee he considered big-inch use for gas during the coal strike last spring and again on October 21 when the present coal strike was threatened but Administrator Littlejohn told him WAA would not want to consider interim use of the lines while bids were pending. As soon as Littlejohn rejected all bids Krug said he began studying concrete proposals.

The plan contemplates that T. G. & T. will lease the lines for 4 months at a rental of 6 cents per 1,000 cu. ft. transported and will also assume cost of the maintenance contract, so that the Government will net close to $1,000,000 from the deal.

Within 5 or 6 days the line can deliver 50,000,000 cu. ft., which will be increased to 100,000,000 cu. ft. in 2 or 3 weeks and to 150,000,000 cu. ft. in 45 days, Krug estimated. While 50,000,000 cu. ft. of gas is the heat equivalent of only 2,000 tons of coal per day, Krug said it would help some since there is already a shortage of natural gas in the Ohio Valley area.

Krug explained that T. G. & T. was chosen as the operator because it is not a bidder for the lines, it has gas reserves which it can put into the lines immediately, and it has men and materials available to begin making connections at once.

It is probable that some of the bidders may protest this decision on the ground that it prevents early disposition of the lines and puts T. G. & T. in a favorable position to bid for permanent acquisition if it so desires. Three of the bidders had also offered to lease the lines for interim gas use.

Interim gas use of the big-inch lines may influence their ultimate disposition, but presumably WAA can consider new bids for either oil or gas use to be effective when the emergency lease expires. Meanwhile the committee is continuing its hearings on the project.

Additional Testimony

John Bauer, public-utility consultant of New York, supported by his attorney, Thurman Arnold, formerly assistant attorney general, told the committee that his bid is the only one meeting the objectives of the Surplus Property Act because he proposes to form a nonprofit mutual cooperative directed by representatives of the federal and local governments, employes, and oil and gas users of the lines, thus preventing monopoly, eliminating speculative profits, and assuring independents access to the lines.

Arnold said major companies on the Atlantic seaboard would have to use the lines because they would offer rates far below tanker charges and to refuse to use them would be a clear violation of the antitrust laws. He added that the majors want big-inch sold for the highest possible price because this would make it less competitive with them and said sale to sources. He suggested the Government retain title to the big-inch lines for future military use for oil but in the meantime use them to transport natural gas from Texas to repressure oil his associates would be a step toward divorcing pipe lines from integrated companies.

Bauer offered $70,000,000 for the lines but said now that all bids have been rejected he is ready to negotiate for a price closer to the appraised valuation of $113,700,000, but warned that it is in the public interest to set a low price so that rates may be cheaper. Whatever the price, Bauer contemplates that the Government will loan him the entire amount, taking junior securities he described as risk capital. Additional funds required would be obtained through floating senior securities with Wall Street underwriters.

H. J. Porter of Houston, president of the Texas Independent Producers and Royalty Owners Association, told the committee the big-inch lines ultimately will be used for gas no matter who buys them because there is not sufficient oil to fill them since most companies would prefer to use existing facilities which are adequate. Use for gas, he said, would benefit Texas producers by providing a profitable market for flare gas, and the volume moved through the lines would not be sufficient to injure the coal industry. He recommended immediate readvertisement of the lines for gas use and sale to the highest cash bidder.

Rear Adm. W. A. Stuart, retired, former head of the Naval Petroleum Reserves, told the committee it is an economic crime to extend the use of natural gas for inferior purposes and recommended creation of a federal conservation commission to prevent waste and uneconomic uses of all refields in the Appalachian area and for emergency relief of present gas consumers during periods of peak demand.

Immediately after Krug testified, FPC announced it had approved the application of Tennessee Gas & Transmission Co. to make emergency use of the big-inch lines under a short-term lease from WAA, and the lines will be operated in close relationship to the company's present system.

Adm. F. J. Horne, chairman of the Army-Navy Petroleum Board, told the committee the military have not changed their view and have consistently recommended that the big-inch lines be disposed of to industry under conditions permitting them recapture for military use in case of emergency, but take no position as to which industry should use them. He said he did not agree with Administrator Littlejohn's earlier testimony that ANPB has taken a new position requiring WAA to restudy the matter.

Asst. Sec. of War Stewart Symington, who was surplus property administrator when the big-inch report went to Congress last January, was closely questioned by the committee as to why his report favored oil use instead of conversion to gas, in the face of engineering reports and oil-industry recommendations for gas use. Symington insisted his staff did not disregard such evidence but disagreed with it because of other information which seemed more significant at that time, including the provisions of the Surplus Property Act that government property should be used to foster small business and prevent monopoly, his belief that the ANPB favored oil use over gas, the apparent lack of interest by possible gas bidders at that time, and expert opinion that the lines would have a lower sales value for gas than for oil.

But he insisted his report was not intended to foreclose sale for gas, and he disagreed with Littlejohn's interpretation that WAA could not

sell for gas without approval of Congress. Symington said if he had remained administrator he would have offered the big-inch for sale for oil and if satisfactory bids were not received would have readvertised for gas use, admitting that today gas bidders value the lines more highly than oil bidders.

Colin C. Rae, of Skelly Oil Co., Tulsa, said his company has gas acreage in the Carthage field which could furnish big-inch 200,000,000 cu. ft. per day for 25 years but which now lacks a market, and he pleaded for the right of consumers in any area to choose their own fuel without government restrictions.

Initial Gas Connection to Big-Inch Line Is Completed

NEAR Many, La., where the 24-in. system of Tennessee Gas & Transmission Co. crosses the 20-in. little big-inch line, T. G. & T. Co. connected the two systems on December 3 with 12-in. pipe to start transmission of natural gas to the Ohio River Valley area as an emergency measure to meet conditions arising from the coal-strike shortage.

At Little Rock, Ark., the 24-in. big-inch will be tied into the 20-in. little big-inch so that the facilities of both former WEP systems may be utilized from that point northward.

Deliveries are being made by T. G. & T. into little big-inch at pressures between 600 and 700 psi. It is expected that deliveries from the former WEP lines will be made the latter part of this week at Ohio connections at approximately 200 psi. This program must necessarily be carried out without compressors. The estimate of 50 million cubic feet a day is regarded as conservative by those concerned with the project, and it is likely that this volume will be increased.

The nearest station west of Many, La., on the T. G. & T. system is Jasper, Tex., station No. 4 which operates normally at 750 psi. The company is now constructing compressor station No. 5 at Many. Because of the excess capacity in the T. G. & T. system between Corpus Christi, Tex., and Monroe, La., it is possible for the company to deliver into the little big-inch without decreasing its regular deliveries being made at the rate of 280,000,000 cu. ft. per day to its terminus in West Virginia. As a result of recent Federal Power Commission permit, T. G. & T. throughput has been raised from 264,000,000 cu. ft. daily.

The former WEP 24 and 20-in. lines are now filled with nitrogen at 40 to 50 lb. pressure. It is anticipated that 2 or 3 days will be required to move the nitrogen out of the former WEP lines as the natural gas advances. It is possible that some of this nitrogen may be pushed beyond Ohio into the unused former WEP lines. There may be a delay of 1 or 2 days before deliveries of gas can be made which is undiluted by nitrogen.

T. G. & T. obtains gas from both the Corpus Christi and the Carthage, Tex., areas. Deliveries in the Ohio River Valley will be made to East Ohio Gas Co. and Columbia Gas & Electric Co. systems, both of which are now customers of T. G. & T. Arrangements for making connections with former WEP lines and the customers are subject to decisions of FPC.

FPC Approves Michigan-Wisconsin's Natural-Gas-Line Project

WASHINGTON.—The Federal Power Commission has issued Michigan-Wisconsin Pipe Line Co., a new company, a certificate authorizing construction of a natural-gas line from Hansford County, Texas, to the Austin storage field near Big Rapids, Mich., with a branch transmission line into Wisconsin and laterals to serve cities on its route.

The commission denied the petition of Panhandle Eastern Pipe Line Co. to dismiss the Michigan-Wisconsin application, but granted Panhandle's separate application for authority to install additional compressor capacity and loop its line from Texas to Michigan to increase the present 393,000,000 cu. ft. capacity of its system to 473,000,000 cu. ft. daily.

These actions terminate a bitter fight in which Panhandle sought to prevent a new concern from entering its Michigan markets, contending that under the grandfather clause of the Natural Gas Act it has exclusive right to supply wholesale gas to its service area. Michigan-Wisconsin proposes to supply additional needs of Michigan Consolidated Gas Co. in the Detroit and Ann Arbor areas and threatens to take this entire market from Panhandle in 1951, though Panhandle told FPC it is able and willing to supply the additional gas needed in that area.

The commission ruled it does have authority to permit another gas pipe line to serve an area already getting natural gas and that the grandfather clause does not give an existing line a permanent exclusive right. In granting Panhandle permission to loop, FPC said additional gas is needed to meet firm demands of various communities along its line but that it may not serve new customers without specific approval of the commission. The order declared Panhandle is entitled to reasonable protection in its markets and an opportunity to participate in their growth but it has not applied for sufficient facilities nor demonstrated its ability to serve adequately the needs of the Michigan market in addition to the expanding requirements of its markets in Indiana, Illinois, and Missouri.

The certificate issued Michigan-Wisconsin permits initial installation of only two compressor stations and contains many special conditions, including submission of revised rate schedules, approval of the financing plan by the Securities and Exchange Commission, approval of the State of Wisconsin and Wisconsin municipalities for the proposed construction, and submission and approval by FPC of a new contract with Michigan Consolidated covering distribution of gas in Michigan and use of the Austin and Reed City storage fields. Michigan-Wisconsin is prohibited from building lateral lines into Detroit, Ann Arbor, and Mount Pleasant, Mich., and may not sell gas to Michigan Consolidated for resale in these areas until FPC has approved a contract which gives due regard for Michigan Consolidated's contract with Panhandle and to Panhandle's grandfather rights, its existing contracts, and its rights and obligations after termination of present contracts in 1951.

Chairman Olds and Commissioner Draper dissented from the majority action, and supporting and dissenting opinions will be filed later.

Michigan-Wisconsin Pipe Line Co. is a subsidiary of Michigan Consolidated Gas Co. Michigan Consolidated is controlled by American Light & Traction Co.

Harry Fink is general manager of Michigan Consolidated which has its general offices in Detroit. W. G. Woolfolk, Chicago, president of United Light & Railways, is board chairman.

Estimated cost of the Michigan-Wisconsin project is $84,000,000.

Possibilities of Liquid Fuel From Coal Described by U. S. Official

NEW YORK.—Although liquid and gaseous fuels make up only 1.2 per cent of the mineral-fuel reserve of the United States, the reserves of coal and lignite can be used to supplement "declining" reserves of natural gas and petroleum for "certainly not less than 1,000 and probably for 2,000 years," according to Arno C. Fieldner, chief of the fuels and explosives branch, Bureau of Mines, who spoke this week during the fuels session of the annual meeting of the American Society of Mechanical Engineers.

Fieldner estimated the presently proved fuel reserves of the United States at an energy equivalent of 2.6 trillion tons of bituminous coal having a heating value of 13,000 B.t.u. per pound. Coal and lignite comprise 98.8 of this reserve. Fifty-five per cent of this solid-fuel reserve consists of high-volatile bituminous coal, 23 per cent subbituminous coal, 19 per cent lignite, 2.5 per cent low-volatile bituminous coal, and 0.5 per cent anthracite.

"All of these fuels can be converted by suitable processes to gaseous and liquid fuel," he said. "Satisfactory fuel gases have been manufactured from coal or from coke and petroleum for many years. Processes and equipment for this purpose have been well developed, and the costs are known. In recent years in Germany, in particular, processes have been developed and put into commercial operation for the manufacture of liquid fuel from coal and from lignite.

"It is quite reasonable, therefore, to assume that plenty of gaseous and liquid fuels will be available in the future for many years, probably a thousand," he continued, "and, of course, for a much longer period if atomic energy can be harnessed economically for the generation of heat and power. The cost probably will be greater than the present cost of petroleum and natural gas, but future developments in the more efficient utilization of fuels should go far in offsetting the cost of conversion."

Fieldner said that petroleum may be supplemented by: alcohols from the fermentation of vegetable matter; conversion of natural gas by the gas-synthesis process; distillation of oil shale; liquefaction of coal or lignite by the high-pressure hydrogenation process; and conversion of water gas from coal or lignite by the gas-synthesis process. Any or all of these supplementary sources may come into use as petroleum supplies decline to the point where these higher-cost symethetic products become commercially competitive with natural petroleum products, he said.

The two processes for the direct production of synthetic liquid fuels from coal or lignite are the coal-hydrogenation, or Bergius-I.G. process, and the gas-synthesis, or Fischer-Tropsch, process, Fieldner said. Both processes were invented and developed in Germany and were in commercial use in Germany for several years before the beginning of World War 2. Liquid fuel is a primary product in both processes; combustible gases and solid waxes are obtained as byproducts.

Imperial Oil Buys Four T-2 Type Tankers

TORONTO.—To provide more efficient transportation from the United States and South American oil ports for both crude oil and petroleum products, Imperial Oil, Ltd., has purchased four T-2 type tankers from the U. S. Maritime Commission.

"Imperial Quebec" is the name of the first tanker which will go into operation with a cargo of crude from Caripito, Venezuela. By the end of December the other three are expected to be on the seas.

These tankers replace four ocean-going tankers which Imperial lost during the war through enemy action. The 16,600-dwt. ships are 525 ft. long with a 68-ft. beam and carry approximately 145,000 bbl. Crew accommodations provide private and semi-private quarters. "Imperial Quebec" is the fastest tanker ever to fly the Canadian flag. It has a speed of 14½ knots. Imperial Oil is a subsidiary of Standard Oil Co. (N. J.).

December Texas Gas-Field Allowable Nearly Doubled

AUSTIN. — December gas allowables for most Texas fields will be nearly twice the November quota, the Texas Railroad Commission decided this week. The sharp increase is to meet peak winter demands.

Carthage field, Panola County, was raised from 268,832,460 cu. ft. daily to 428,324,193 cu. ft. daily in December. Whelan field, Harrison County, will be allowed 16,290,323 cu. ft. daily in December, compared with 7,666,666 cu. ft. in November. Other December allowables are: Sipe Springs field, Eastland and Comanche counties, 1,645,000 cu. ft. daily; La Blanca field, Hidalgo County, 7,678,032 cu. ft. daily; and Alief field, Harris County, 5,967,742 cu. ft. daily.

Gas production from Rodessa field was cut from 29,566,666 cu. ft. a day in November to 27,922,581 cu. ft. daily in December. Panhandle sweet gas fields are unprorated and production of sour gas for carbon-black manufacture remains at 750,000,000 cu. ft. daily.

Huge Shop-Fabricated Vessel Reaches Whiting

CHICAGO.—After a 105-mile trip on Lake Michigan from Milwaukee, Wis., one of the largest shop-fabricated vessels ever made arrived at its destination at Whiting, Ind., December 1.

Measuring 108 ft. long and 16 ft. 2 in. in diameter and weighing 155 tons, too large and heavy to be transported a long distance by railroad or truck, the cylindrical vessel is a fractionating tower for the new fluid catalytic cracking unit under construction at the Whiting refinery of Standard Oil Co. (Ind.).

The fractionating tower was moved from the Milwaukee plant of the A. O. Smith Corp., where it was built, on two specially rebuilt railroad flat cars 4 miles to the lake front and then skidded on to a barge to be towed by tug to Whiting. At Whiting the tower was to be slid off the barge and on to railroad flat cars and hauled approximately 1½ miles to the refinery. The new Whiting unit is scheduled to be completed next year.

Texas Planning Tidelands Leasing to 27-Mile Limit

AUSTIN.—Revision of the state's policy to allow leasing of the Texas Gulf Coast tidelands to the 27-mile limit is expected by the incoming Public School Land Board when its two new members take office in January.

Bascom Giles, chairman of the board, said the new policy was agreed upon in conference with Beauford Jester, governor-elect, and Price Daniel, attorney-general-elect, the two new members.

The area between the 3-mile limit and the 27-mile limit is estimated to contain approximately 7,000,000 acres of submerged lands. Giles said the land will be put up for lease when the demand is of sufficient importance to warrant it.

THIS 1946 WEEK

S	M	T	W	T	F	S

NATURAL GAS—Interior Secretary Krug announces plans for immediate conversion of big-inch lines to natural gas. . . . Tennessee Gas & Transmission Co. to get 4-month emergency lease and operation certificate. . . . Krug says lines will carry 150,000,000 cu. ft. daily in 45 days. . . . ¶Michigan-Wisconsin Pipe Line Co. is granted authority to build $84,000,000 natural-gas line from Dallas to Wisconsin and Michigan. . . . ¶Colorado Interstate will lay 300-mile 20-in. line from Hugoton field to Denver in 1947. . . . ¶Tennessee Gas & Transmission Co. ready to let contracts for 100 miles of 16-in. feeder lines in San Salvador, Tex., area. . . .

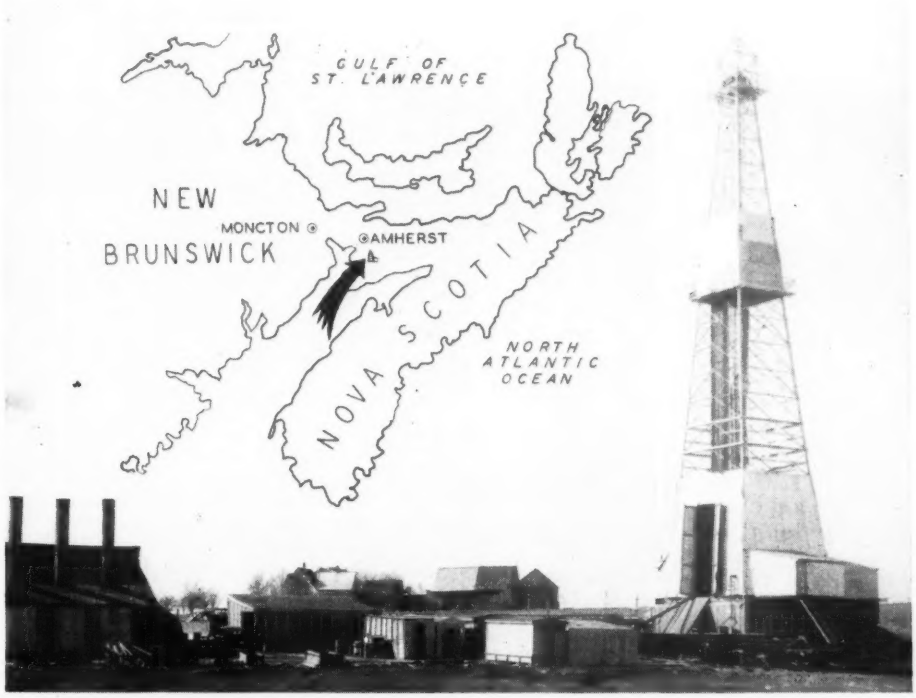
REFINING—Ashland Oil & Refining Co. is negotiating with Government for lease of $16,000,000 Kentucky refinery. . . . Ashland President J. Howard Marshall says lease terms and plans for use still indefinite. . . . ¶Shell announces plans for immediate construction of $10,000,000 lubricating-oil-manufacturing plant adjacent to present refinery on Houston Ship Channel. . . . ¶Firemen save Eastern States Petroleum Co. refinery at Houston from flames which destroyed an oil-storage area and burned nine persons. . . . Loss estimated at $30,000. . . .

INTERNATIONAL—Juarez Mayor Bermudez named manager of Petroleos Mexicanos by new president, Miguel Aleman. . . . Aleman promises efficiency to replace political expediency in petroleum industry. . . . Reorganization of Pemex expected. . . . Swedish Government reported seriously considering nationalization of petroleum distribution industry. . . . Control of other petroleum activities expected to follow. . . . ¶UNRRA reportedly will seek bids soon on an additional 1,000,000 bbl. of crude for use in Italian refineries. . . . ¶Hope that Middle East will succeed America as crude-oil source is given as basis for rebuilding Western Europe's destroyed refining industry. . . . Two to three years may see completion of conversion.

RESEARCH—Carter Oil Co. to double size of Tulsa laboratory in $225,000 expansion program. . . . Construction to be completed in mid-1947. . . . ¶Gasoline derived from natural gas already competitive with petroleum-derived fuel, says Robert P. Russell, president, Standard Oil Development Co. . . . Third of Standard's research efforts now being devoted to conversion of natural gas and coal into liquid fuels. . . .

PRODUCTION—World's drilling-depth record expected to be set by Western Oil Corp. wildcat in Kern County, California. . . . Drilling at 16,593 ft. at last report, well is only 62 ft. away from record set last year in Texas by Phillips Petroleum Co. . . . ¶Kansas district judge reverses 15-bbl.-allowable ruling of Corporation Commission. . . . Holds commission has authority to increase allowable. . . .

EXPLORATION—Stockholders authorize Pantepec to buy major interest in leases on about 4,600,000 acres of potential oil lands in Florida. . . . Purchase figure set at more than $1,000,000. . . .



The unending efforts of the petroleum industry to find oil are exemplified by Sun Oil Co. in this, its second test well in Nova Scotia. Last reported down to approximately 7,800 ft. in the upper Horton sand, the company, which is doing its own drilling, is going for the Albert series, estimated at around 10,000 ft. Sun abandoned its first Nova Scotia well November 30, 1945, at 6,506 ft. when tools were lost. Bad weather delayed skidding of the rig 150 ft. to a new location until March 27 of this year, when this well was spudded. The well shown here is 5 miles south of Amherst, in Cumberland County, and is being drilled in the Minucle anticline as determined by the Canadian Geological Survey. Sun has an 8,640 sq. mi. concession in the county, obtained under exploratory grants from the Nova Scotia provincial government

Portion of U. S. continental shelf adjacent to oil-producing areas

Pratt Sees Great Oil Potentialities On Continental Shelf, Slope

by Charles J. Deegan

THERE is probably two and one-half times as much oil to be found beneath the continental shelves and continental slopes of the world as there is under the dry land surface, Wallace E. Pratt, retired vice president of Standard Oil Co. (N. J.), said in a talk before the Tulsa Geological Society this week.

Wallace defined the continental shelf as the marginal, shallow waters which surround the continents, limited to a depth of about 600 ft. He explained that the 600-ft. depth was not arbitrary but quite logical. The continental shelf is the outer, or seaward, half of one of the conspicuous features of the earth's surface; namely, the shelving plain, which over much of the earth, forms the solid surface extending from the continental heights to the oceanic depths.

The inland, upper edge of this plain, at an elevation of about 600 ft. above sea level, marks the mean level of the surface of the terra-aqueous globe; its lower edge, at an elevation of about 600 ft. below sea level, marks the beginning of the steep dip, designated as the continental slope, into the deep oceanic basins proper.

Its outer edge also marks the depth limit of effective wave and current action on the sea floor and the limit to which sunlight is able to penetrate below the surface of marine waters.

The present volume of water in the oceans is such that it entirely covers the foundations on top of which the continental land masses are perched and rises sufficiently higher to submerge the outer half of the low-lying continental edges. The continental edges are a great shelving, marginal plain, comprising about 10 per cent of the entire surface of the earth, and the outer half is covered by the seas.

Wallace E. Pratt, retired vice president of Standard Oil Co. (N. J.), and an outstanding petroleum geologist, is speaking on "Petroleum on the Continental Shelves" before various local geological societies under the auspices of the distinguished-lecture committee of the American Association of Petroleum Geologists. The subject is a matter of great interest, not only among gelogists but oil men generally. Following his Tulsa appearance, he will speak in Dallas December 9, Fort Worth December 10, and at Midland, Tex., December 12.

Beneath the dry land half of this plain are situated the natural reservoirs from which have come the overwhelming bulk of all the oil the world has consumed in the past, together with those which contain an even greater proportion of our currently proved petroleum reserves. The question is: what are the prospects for oil under the adjacent submerged half of this plain?

Pratt answered his query by pointing out that the dry-land area of the world contained about 15,000,000 sq. miles of surface, under which the sedimentary section was favorable to the formation and accumulation of oil. Considering the average thickness of the sedimentary section of

THE EARTH'S CONTINENTAL SHELF AREAS

Location:	Area, sq. miles	Depth
Atlantic Ocean:		
Americas		
Newfoundland shelf	345,000	450 to 600 ft.
Florida-Texas shelf	385,000	Mostly less than 150 ft.
Campeche shelf	170,000	Mostly less than 150 ft.
Guiana shelf	485,000	Mostly less than 150 ft.
South Brazil shelf	370,000	Mostly less than 150 ft.
Patagonian shelf	960,000	Mostly less than 150 ft.
Africa:		
Agulhas shelf	75,000	Mostly over 300 ft.
Europe:		
British shelf	1,050,000	Mostly under 300 ft.
Arctic Ocean:		
Norwegian shelf	93,000	600 to 900 ft.
Iceland-Faroe shelf	115,000	600 to 900 ft.
Barents shelf	830,000	600 to 900 ft.
North Siberian shelf (Nova Zembla to 155° W. Long.)	1,330,000	One-half under 150 ft.
Indian Ocean:		
Africa		
Zambesi shelf	55,000	Mostly under 150 ft.
Asia		
Bombay shelf	230,000	150 to 300 ft.
Burma shelf	290,000	Mostly under 300 ft.
Australia		
NW. Australia shelf	590,000	150 to 300 ft.
S. Australia shelf	320,000	150 to 300 ft.
Pacific Ocean:		
Australia		
Tasmania shelf	160,000	150 to 300 ft.
Queensland shelf	190,000	Mostly under 300 ft.
Arafura shelf	930 000	150 to 300 ft.
Borneo-Java shelf	1,850,000	150 to 300 ft.
Asia		
Tonkin-Hongkong shelf	435,000	Mostly under 300 ft.
Tunghai shelf (Strait of Korea, Formosa to Strait of Korea)	915,000	Mostly under 300 ft.
Okhotsk-Sakhalin shelf	715.000	150 to 300 ft.
Behring shelf	1,120,000	One-half under 150 ft.

(From "Treatise on Sedimentation," by William H. Twenhofel.)

about 1⅓ miles, this represents about 20,000,000 cu. miles of potential oil-bearing sediments under the dry land area of the earth.

In contrast to the 15,000,000 sq. miles and 20,000,000 cu. miles of potential dry-land oil-bearing territory, he gave figures for the continental shelf, plus the continental slope (the slope down to a 3,000-ft. water depth). The shelf plus the slope has about 17,000,000 sq. miles of potential oil-bearing sediments, but since the average thickness of the favorable sedimentary section is considerably greater than under the land area, the total cubic miles of favorable oil sediments under water is between 50,000,000 and 55,000,000 cu. miles.

Therefore, in the light of present geological knowledge, Pratt concluded that the potential oil resources of the continental shelf and continental slope combined should bear the same ratio to the potential resources of the dry-land area, as the cubic miles of favorable sedimentary section. This ratio is 50,000,000-55,000,000 to about 20,000,000, or at least two and one-half times.

Pratt quoted, as his source of data on sedimentary areas, Twenhofel's well-known "Treatise on Sedimentation" and the accompaying table showing data on continental shelf areas is taken from that source.

From his own experience, and the data cited, the speaker ridiculed the pessimists who talk about running out of oil. He stated that in his belief it was logical to conceive of the earth as an organism, one of whose functions it always had been, and likely always would be, that of supporting plants which would extract carbon dioxide from the atmosphere; then die off and be buried in the sediments of the earth, carrying with them the carbon content, which under proper environment conditions, would result in the formation of oil. There is no reason to believe, he said, that the formation of oil is not one of the routine functions of the earth's cycle.

Carter Will Expand Research Facilities

TULSA.—Plans for a $225,000 expansion of its Tulsa research laboratory were announced last week by Carter Oil Co.

Carter officials said the program will more than double the present size of the laboratory, in which much of the geophysical and production-research work for Standard Oil Co. (N. J.) and its affiliate companies is done. Construction is expected to be completed by the middle of 1947. The program consists of construction of a two-story wing and a new shop building.

Carter has operated a research laboratory more than 10 years. It gained national attention last year when the Navy revealed that Carter research workers aided in developing safety devices used in the proximity fuse.

The research program is under the direction of H. F. Moses, vice president. Other officials include: Dr. P. S. Williams, chief of research; Dr. A. B. Bryan, chief geophysicist; R. W. Gemmer, assistant chief geophysicist; and P. W. Whitaker, shop foreman.

Ickes Attacks Government Big-Inch Policy

WASHINGTON. — Former Interior Secretary Harold L. Ickes attacked War Assets Administration for delay in selling the lines and for giving preference to oil use, and particularly criticized Secretary Krug for awarding a temporary lease to Tennessee Gas & Transmission Co. Ickes testified Tuesday before the House surplus property committee. (More details regarding testimony at hearing are presented on page 58).

In a series of innuendos and rhetorical questions Ickes inferred that T. G. & T. is controlled by Standard Oil Co. of New Jersey which wants to prevent competitors from obtaining big-inch; that major oil companies want to control the line so as to dump cheap oil in the Middle West to ruin independents; that Reconversion Administrator John R. Steelman, acting on behalf of John L. Lewis, brought pressure on WAA to prevent sale to gas bidders; that WAA was subservient to sinister coal and railroad interests; that the oil bids were not sincere; and that the temporary lease to Tennessee Gas is a scheme to suppress competition and delay sale of the lines.

Ickes recommended immediate sale to the highest cash bidder for gas as a conservation measure to utilize waste gas and provide competition to coal in the Northeast.

Texas High Court Denies Trapp Case Rehearing

AUSTIN. — The Texas Supreme Court last week overruled a motion for a rehearing of the controversial Trapp case in which the court limited the scope of judicial review of spacing-rule orders issued by the Texas Railroad Commission. Interest in the case was such that some 40 amicus curiae briefs were filed to support the motion for a rehearing.

A majority opinion, written by Associate Justice C. S. Slatton, applied the "substantial evidence rule" to orders of the commission, to the effect that courts cannot look behind findings of the commission if its orders are based on "substantial evidence."

However, Chief Justice Alexander dissented from the court's decision and wrote a dissent on the action of the majority in denying the motion for a rehearing. "The effect will be to deprive the individual of the right to a trial by jury in all cases in which a board, bureau or commission is involved, even though it affects his constitutional rights," he said. "I cannot subscribe to such a holding."

First Bidding Due Under Royalty-Oil Preference Act

WASHINGTON.—Bids for purchase of government royalty oil from Kettleman North Dome field in California and Salt Creek field in Wyoming will be opened by the U. S. Geological Survey December 17.

This is the first competitive bidding under the act of last July 13 which gives a preferred option to small refiners with inadequate supplies of crude. Purchasers must arrange their own transportation but may exchange royalty oil for other oil if this does not involve resale by the purchaser. Bids may be for the entire amount or for one-half the royalty oil from each field, which in 1945 was 785,000 bbl. from Kettleman and 390,700 bbl. from Salt Creek.

Revenue From Gasoline Taxes Below Last Year

Gasoline was the source of $39,237,189.31 in internal-revenue collections during October, according to a comparative statement issued by the Treasury Department. The figure was $4,576,169.23 below collections for the same period in 1945.

Collections from the tax on lubricating oils totaled $6,040,338.27 during the month, against a higher figure of $7,001,490.33 during the same period last year.

From pipe-line operations the Government received $1,566,212.21, an increase of $151,416.35 over October 1945.

Oklahoma, Louisiana Allowables Increased

Slight increases in daily allowables for December were ordered last week by the Oklahoma Corporation Commission and the Louisiana Department of Conservation.

Oklahoma's allowable was pegged at 362,400 bbl. for both December and January, compared to an allowance of 361,318 for October and November. The Louisiana allowable was set at 444,411 bbl. for December, against 440,000 bbl. in November.

International

WORLD-WIDE OIL DEVELOPMENTS

Europe Looking East for Crude Supply, Hulse Finds

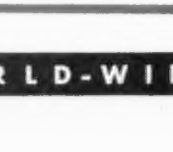
WESTERN Europe is rebuilding its war-shattered refining industry in the expectation that the Middle East will ultimately supplant America as its source of crude oil, Sam I. Hulse, Warren Petroleum Corp. vice president in charge of marketing, found on a recent 6 weeks' European trip.

Accompanied by G. L. Brennan, manager of Warren's liquefied petroleum gas division, Hulse visited England, France, Switzerland, Belgium, The Netherlands, Denmark, and Sweden. Purpose of their trip was to renew prewar contacts for Warren's products in the light-hydrocarbon field.

"Generally, Europe is rebuilding to operate on cheaper Middle East and South American sour crudes," Hulse said. "They realize it is the economical thing for them to do. Once their reconversion is complete, our best market there would seem to be for refined products, particularly specialties, and equipment."

Hulse estimated it will take from 2 to 3 years for the refining industry in Western Europe to regain completely its prewar status. Lack of petroleum products in the meantime is making the return to peacetime conditions even more difficult. Belgium, he said, seems to be recovering most rapidly, and this is due largely to the fact the authorities recognized early the importance of making gasoline and other fuels available to the country. Sweden is making rapid strides in the petroleum field with a new refinery at Goteborg and a large shale-oil program.

The outlook for sales of liquefied petroleum gas in Europe is not particularly bright for the immediate future, Hulse said. "The main trouble is a lack of appliances. The Germans stripped the country of most of the small LPG tanks that were used in such countries as France before the war. A new supply of appliances is, of course, tied in with the bigger question of general industrial recovery."



S. I. HULSE

G. L. BRENNAN

The Warren official said estimates of the percentage at which the European refining industry is now operating range from 25 to 40 per cent of prewar capacity. A principal stumbling block in rebuilding, he added, is the lack of American dollar credits to provide imports. Most countries are like England in conserving their dollar credits for only the most essential purchases.

Hulse pointed out European engineers are looking for a new source for the equipment, particularly precision tools and machinery, which they obtained from German manufacturers before the war. He said American equipment is highly regarded, and that one refinery engineer told him that, even if he could, he would not return to German-made equipment because of its intricate design and the fact that as a rule it cannot be replaced except from Germany.

Free Choice of Crude Source Sought in France

PARIS.—Owners of French refineries must have a free choice insofar as determining the source and type of charging stock.

This is one of the conclusions reached by the French refinery-modernization committee and is considered a prime requisite for a prosperous postwar refining industry in this country. Other government guarantees which the committee considers necessary include:

War damage be granted without delay and in accordance with the plans for the reconstruction of damaged enterprises and that facilities be granted for concentration of industries and for the repayment of profits on foreign investments. Assurances of custom protection is another guarantee seen as a necessity.

Until France develops substantial indigenous production, much of its crude is likely to come from the Middle East and South America.

Indicative of current French needs are the following figures:

Imports into France during the November 1-7 period, compared with the weekly average in 1938:

	Metric tons*	
	Nov. 1-7	1938
Crude	80,483	134,000
Gasoline	18,240	13,250
Fuel oil	14,300	7,650
Lubricating oil	6,536	1,800

Domestic refinery output during the week of November 1-7 compared to the weekly average in 1938:

Gasoline	1,946	46,000
Fuel oil	489	31,500
Gas oil	7,557	8,500
Kerosene	2,830	3,250

*A metric ton is equivalent to approximately 7.454 42-gal. barrels, assuming a 36° A.P.I. crude.

Progress Made on Two New Colombian Wells

BOGOTA.—On the eleventh test, Texas Petroleum Co.'s 1 Velasquez had a good show of oil with a very small amount of gas. An accurate flow test has not yet been made.

Texaco's 1 Velasquez was drilled to 8,455 ft. on the Teran-Guaguaqui fee property, located about 120 miles south of Barranca Bermeja. About 800 ft. of pay is still to be tested.

As soon as operations are complete here another test will be spudded. Plans call for using the same rig. The derrick is now being built.

Nationalization Reported Considered by Sweden

STOCKHOLM. — Authoritative reports that the Swedish Government is seriously considering the nationalization of petroleum distribution is linked here with the Soviet-Swedish trade agreement which was vigorously opposed by the United States.

If petroleum distribution is nationalized—and at present Sweden imports all its petroleum products—then it is thought that all other petroleum activities will be nationalized. This would include the 393-mile pipe-line project, which is to get under way as soon as materials are obtainable, and any future potential production or refining. Recently a report from the United States stated that two crude-topping and reforming units would be sent here.

The exact degree of Russian influence in Sweden's nationalization plans is not known. The Swedish financial agreement extends Russia credit approximating 1,000,000,000 krona ($278,000,000).

If Sweden's oil activities are nationalized it will mean that American and British oil offices here will have to be closed. Verbal opposition is expected, but as the U. S. State Department was completely ignored when it protested the Swedish-Russian trade agreement, the consensus is that a postponement is all that can be expected from oil-company protests.

An estimated 13,500 filling stations are in Sweden. It is proposed to cut this number to about one-fourth if nationalization laws are enacted by the Riksdag. The employes presumably would be "transferred to other occupations where their service is more in need."

Imports of crude and fuel oil in 1946 are expected to amount to about 850,000 tons (5,950,000 bbl.), compared with 690,000 tons (4,830,000 bbl.) in 1939. A. Johnson & Co., in Stockholm, operate a refinery whose daily capacity is 7,500 bbl., with a 3,500-bbl. cracking capacity. Most of the refinery's crude comes from the Middle East.

Two More Rotary Rigs Shipped to Chile

NEW YORK. — Two more rotary rigs have been shipped to Chile and expectations are that they will be in operation by March. One probably will be used for development drilling in the Spring Hill oil field and the other possibly for wildcatting—maybe near San Sebastian, 40 miles south of Spring Hill.

Chile's fourth test in the Spring Hill field is now down below 4,000 ft. and expectations are that it will be completed by the middle of December. Projected depth is around 7,500 ft. Pipe-line-construction plans are still in the formative state.

The fourth test is located about 1,500 ft. east of the third well. Drilling operations are being conducted by the government-owned Corporacion de Fomento da la Produccion (Chile). The Spring Hill field is located in the Tierro del Fuego archipelago, on the southernmost tip of Chile.

Colombian Leader Studying Mexican Nationalization

BOGOTA.—While Colombia's Dr. L. Gomez, chief of the Conservation Party here, is in Mexico at the inauguration ceremonies of Mexico's President Miguel Aleman, he will take time to study the Mexican oil industry and to determine the degree of efficiency obtained since expropriation, with the thought of what his country could gain by similar action.

Gomez, in an exclusive interview with a correspondent for the Mexico City newspaper "Excelsior," however, added that the possibility of petroleum nationalization in Colombia would depend, among numerous other factors, upon the production results of Mexico's nationalized oil industry.

Pauley Suggests Let-Alone Policy on Jap Oil Industry

WASHINGTON.—A proposal that Japan's crude-petroleum-production facilities be immune from reparations has been submitted to President Truman by Edwin W. Pauley, United States reparations representative.

In a comprehensive report on Japanese reparations, Pauley recommended complete removal of all plants devoted to the production of synthetic rubber and substantial removal of chemical-production facilities, railroad equipment, and rolling stock.

The Department of State said the report was completed in April and was submitted to that department for review by the State-War-Navy Coordinating Committee before presentation to the president.

Soviet Researchers Find New Catalytic Process

A new domestic catalytic-cracking process has been developed by the Soviet petroleum industry and research institutions, according to information received by the Foreign Commerce Weekly, publication of the Department of Commerce.

The Russian report said high-octane gasoline was produced from naphthyl and paraffin in experimental distillations. The tests are being made at a pilot plant in Grozny.

Bids to Be Asked on Crude for Italian Plants

NEW YORK.—United Nations' Relief and Rehabilitation Administration, acting through the U. S. Navy, is about to ask for bids on an additional 1,000,000 bbl. of crude for use in Italian refineries.

Specifications are expected to be the same as in the two recent bids—both of which went to Arabian American Oil Co. At that time, crude of 34°-37° A.P.I. gravity was sought, with a maximum of 1.7 per cent sulfur and 1 per cent b.s. and w.

The additional 1,000,000 bbl. will be billed to UNRRA sometime in December and is for January-February delivery. Previously the two bids were for 787,000 bbl. and 212,000 bbl., respectively, with Arabian American the low bidder each time. The successful bid: $1.13, f.o.b., Ras Tanura. U. S. Maritime Commission tankers moved the Arabian crude and a similar arrangement is planned for the 1,000,000 bbl. now to be bid on.

UNRRA in Europe ceases to exist December 31. Speculation as to future Italian crude supplies indicates that the transition period between the ending of UNRRA and the return to free trade may be handled with money from a $100,000,000 Export-Import Bank loan.

While the December UNRRA-Navy bids are open to all interested parties, oil circles here believe that some Middle East oil interest probably will be the successful bidder. (Details on the 787,000 bbl. purchase from Arabian American were published in The Journal, October 26, p. 78.)

Belgian Rationing Ends

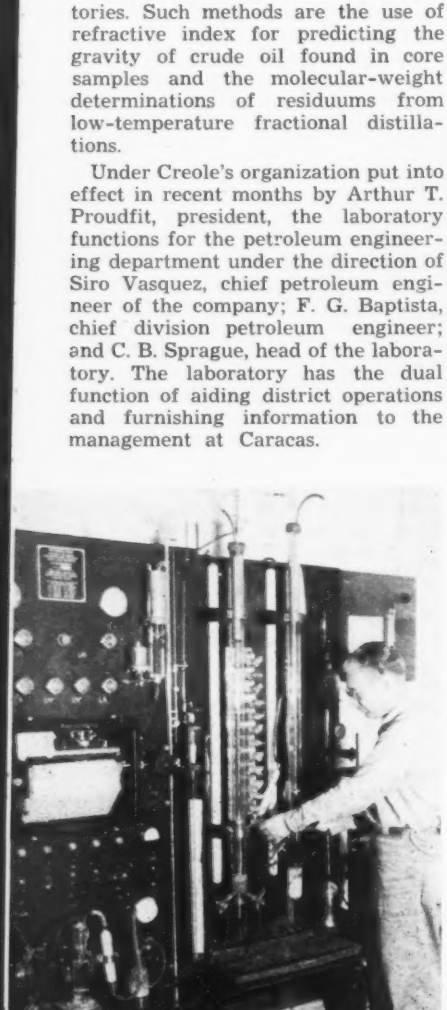
Rationing of gasoline, other motor fuels, and lubricants for automobiles has been discontinued in Belgium, according to information received by the Foreign Commerce Weekly, publication of Department of Commerce. All restrictions designed to limit use of automobiles also have been removed. Current price of gasoline in Belgium is 40 cents a gallon.

Creole's Laboratory Aids District Operations And Furnishes Information to Management

by Paul Reed

IN the program for effective application of engineering principles to oil production in eastern Venezuela, the laboratory of Creole Petroleum Corp. at Caripito has performed a vital function. Although this production laboratory is regarded as being engaged primarily in conducting routine tests rather than for research some of the methods are quite significant since they are seldom to be observed outside of research laboratories. Such methods are the use of refractive index for predicting the gravity of crude oil found in core samples and the molecular-weight determinations of residuums from low-temperature fractional distillations.

Under Creole's organization put into effect in recent months by Arthur T. Proudfit, president, the laboratory functions for the petroleum engineering department under the direction of Siro Vasquez, chief petroleum engineer of the company; F. G. Baptista, chief division petroleum engineer; and C. B. Sprague, head of the laboratory. The laboratory has the dual function of aiding district operations and furnishing information to the management at Caracas.



International
WORLD-WIDE OIL DEVELOPMENTS

Above: Chemical-analysis section of petroleum-engineering laboratory of eastern division of Creole Petroleum Corp. at Caripito, Venezuela. Left: Podbielniak column for analysis of gas and condensate samples

The laboratory contributes to the high efficiency attained by Creole in its large eastern Venezuelan operations through engineering data utilized in reaching decisions regarding well spacing, completions, and numerous aspects of reservoir engineering. Quite apart from the program of the Caripito laboratory is that of the newly organized research department.

The utilization of refractive index data has been valuable where the quantities of oil obtained from core samples have been too small for measuring gravity of crude oil by the usual methods. Refractive index predictions of gravity aid in helping to reach correct decisions in regard to selecting formations in which to complete wells in fields being developed, and in determining the significance of formations encountered in wildcat wells.

The refractive index method gives an indication of the gravity of the oil with sufficient accuracy. A correlation chart is utilized which shows the relation between the gravities of the various crude oils studied and their refractive indices. The quantities of oil available for gravity determinations from eastern Venezuelan cores, often being only a drop or two, are too small for pycnometer measurements. Refractive index data are more accurate for predicting A.P.I. gravity than the alcohol-water suspension method by which a mixture of alcohol and water is made in various proportions in order to discover which one is capable of holding a drop of oil in suspension at a given position; the gravity of that particular mixture being that of the drop of oil.

Refractive index, used in the determination of specific gravity, has the advantage of being a rapid procedure which requires only one or two drops of oil.

To obtain correct results the prisms of the refractometer are at a constant temperature maintained by circulating water. After a drop or two of oil has been placed on the horizontal surface of the movable prism, the prisms are closed. The telescope of the refractometer is adjusted so that the

boundary between light and dark portions is sharply seen in the field of vision which intersects cross hairs lighted by an illuminating mirror. The index of refraction is read off directly. Readings are accurate to 0.0002.

Refractive index data have been furnished to Creole's geological department. These have been of value in reaching decisions regarding the exploitation of oil-bearing sands. Since gravities of oil frequently vary widely in single fields, it is important to secure reliable advance information.

For some wildcat wells which are distant from fields under production, refractive indices are reported directly to the geological department without interpretation into terms of A.P.I. gravity. It is obvious that A.P.I. gravity relationships may be more readily determined for fields where oil is already being produced from the various formations.

The Caripito laboratory has applied the refractive index method in a comprehensive study of crudes in the Quiriquire field. In this interesting area there are crudes varying in gravity from 11.6° to 36.7° A.P.I. with a tendency for lighter oil to be found in the deeper formations. In some other eastern Venezuela fields there is an opposite relationship of gravities.

Previously the Caripito laboratory had used the familiar method of crushing the core and extracting oil by use of carbon tetrachloride. Better results are obtained with a new solvent, known as Solvent X, devised by the Creole laboratory staff. This solvent has an initial boiling point of approximately 60° C. and is more easily evaporated out than carbon tetrachloride.

Industrial Waters Analyzed

In the laboratory program much attention is given to analysis of industrial waters and oil-field brines in connection with both refining and producing operations. These include refinery waters for boilers and cooling-tower systems. Camp waters are tested for potability for locations as distant as El Sombrero in the State of Guarico. Samples of boiler water for wildcat wells are examined in order to locate sources of difficulties and to prescribe cures.

In most cases the cure for water trouble at wildcat wells is effected by providing adequate settling. Most eastern Venezuelan waters can be readily used in boilers. Much of the territory is sandy llanos country where there is little change in the quality of water from dry to rainy seasons. Rain water sinks into the ground and filters to the streams. The principal trouble has been with corrosion. In country located in clay territory near foothills there has been some temporary and permanent hardness and silt.

Analyses of salt content of crude oil have been a feature of production control in some fields. Much attention is given to salt analyses of crudes of two fields to ascertain that they conform to marketing specifications. On the basis of these data decisions are reached to correct trouble by reducing the sizes of chokes, or closing the well in altogether.

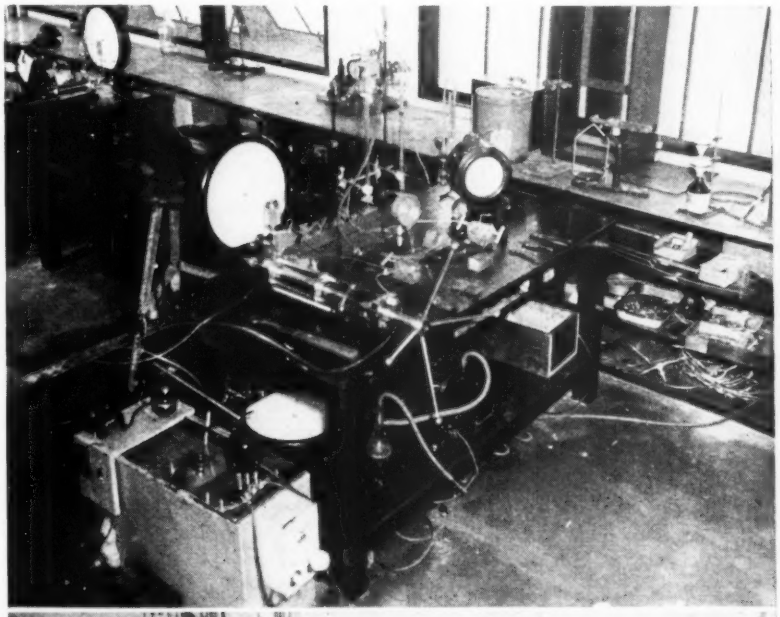
Studies at the laboratory have been made of Jusepin crudes with respect to the planning of a stabilization plant which is to be built. Crude oils

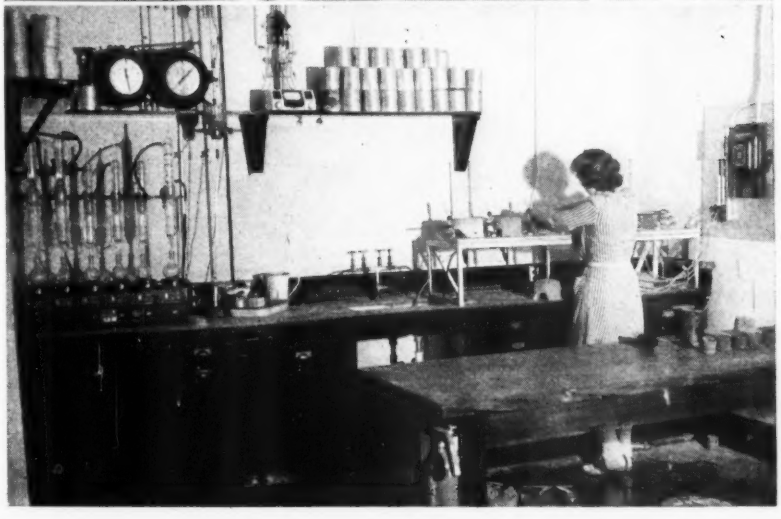
are tested for pour points, vapor pressure, and weathering losses.

Light-end analyses for fractions up through pentane are conducted for crude and gases from eastern Venezuela in a Podbielniak automatic-recording low-temperature fractional distillation apparatus. Molecular-weight determinations are made on residuum of Podbielniak analyses of crude oil.

At least two engineers spend all of their time working with bottom-hole samples which they obtain in the field and bring to the laboratory for analysis.

It has been necessary to alter the technique for porosity determinations





Top: Equipment for analyzing subsurface crude-oil samples, with constant-temperature bath and mercury pump in the foreground; a second unit of this type appears in the upper left corner. Bottom: Core samples from wells are analyzed here. Battery of Soxhlet extractors at left, retort units at right

because of the soft crumbly nature of many of the cores.

Cement-testing equipment has been installed ready for use when occasion may arise which would require it. This includes a consistometer, a testing sieve shaker, a constant-temperature oven for curing cement specimens, a briquet-testing machine, and a laboratory press for compression tests.

The principles of reservoir engineering may be extensively applied in Venezuela since the prevailing practice is to operate fields located in large concessions. Therefore, it is possible to create a gas cap for the benefit of the field without the hampering restrictions arising from a division of royalty interests such as is encountered in the United States. Much is contributed to the effectiveness of Creole's petroleum engineering by the Caripito laboratory.

Incidentally it may be mentioned that because of this situation in Venezuela, Creole will be in a better position than companies in the United States to utilize the advantages of the reservoir analyzer recently acquired by its research department. In the course of a year the laboratory facilities and staff are to be considerably expanded.

Juarez Mayor New Manager of Pemex

MEXICO CITY. — Appointment of Antonio Bermudez, businessman and mayor of Juarez, as general manager of Petroleos Mexicanos and a declaration for "honest efficiency" rather than political expediency in Mexico's petroleum industry highlighted the inauguration of Miguel Aleman as president of Mexico here December 1.

Aleman, who succeeds Manuel Avila Camacho, also appointed Antonio Ruiz Galindo, one of the nation's most influential industrialists, secretary of the national economy, to whose jurisdiction Pemex is expected to be transferred soon.

"It is of public interest to have efficiency in these enterprises," declared Aleman in reference to petroleum and railroad industries. It was impossible to read into his remarks any connotation that private companies will be privileged to reenter Mexico, but repeated references to benefits of a good-neighbor policy advanced this possibility.

Bermudez succeeds Efrain Buenrostro as head of Pemex, which Aleman already has promised to reorganize. Labor difficulties, which constituted Buenrostro's major problem while in office, have not abated. In the Poza Rica oil field, gunshots and arrests were reported as late as November 27.

Natural-Gas Production In Soviet Up 20 Per Cent

MOSCOW.—Moscow Radio states that over a billion cubic meters of natural gas (about 35 billion cubic feet) has been produced in Soviet Russia since the first of this year, a 20 per cent increase over last year's production figures.

Some of the 25 wells now producing natural gas have daily potentials, Moscow Radio says, of from 200,000 cu. m. (7,040,000 cu. ft.) to 250,000 cu. m. (8,825,000 cu. ft.).

It is also stated that hundreds of thousands of cubic feet of high-grade gas are received daily from the recently completed Saratov-Moscow pipe line.

Additional natural-gas deposits reportedly have been discovered near Stalingrad with one well capable of producing 600,000 cu. m. (21,180,000 cu. ft.) daily.

Tuimazy Production Gains; Development Continues

Good progress is being made in the development of the Tuimazy oil field between the Volga River and the Urals in Bashkiria, U.S.S.R., according to information received by the Foreign Commerce Weekly, publication of the U. S. Department of Commerce.

The field is expected to be producing 29,200 bbl. per day from 15 wells by the end of 1946. During 1939 Tuimazy was reported to have produced 219,000 bbl. of Bashkiria's total production of 12,118,000 bbl. By 1950 Tuimazy is expected to be producing 10 per cent of the total Soviet output, the Russian sources said.

Union Plans Location for Second Paraguayan Test

Location for Union Oil Co.'s second exploratory well in Paraguay will be selected in the next 3 or 4 weeks conforming with terms of the concession. Meanwhile the company's first drilling operation is progressing below 7,200 ft. in marine shales.

A third geophysical crew is being sent to Paraguay by Union supplementing the exploratory program. Negotiations are under way between Union and other governments for concessions in the Chaco, but interpretations of legal procedure must be resolved before concession applications become a matter of record.

Shell Transfers Funds for East Indies Reconstruction

AMSTERDAM. — To meet large postwar reinvestment and reconstruction requirements, the Royal Dutch-Shell group has transferred between 20,000,000 and 25,000,000 pounds sterling ($80,000,000 to $100,000,000) to the Netherlands. This transfer has taken place over a period of 6 months.

Royal Dutch-Shell as a whole is a sterling producer and is experiencing a shortage of dollars. Reconstruction work in the Dutch East Indies is expected to cost approximately 500,000,000 guilders ($190,000,000), and part of this will have to be in dollar exchange.

Colombian Oil Bills to Await Future Session

BOGOTA.—None of the four petroleum bills pending before the Colombian congress is expected to be approved during the current session, which will adjourn December 14.

The bills call for substantial amendments to the oil law, creation of a national petroleum council, back payment of consumption taxes on motor fuels and lubricants consumed within the De Mares and Barco concessions, and the expropriation of Tropical Oil Co.'s refinery and Colombian Petroleum Co.'s topping plant to provide a state monopoly of oil refining and distribution for domestic consumption.

Argentine Production Down

BUENOS AIRES.—July crude production in Argentina dropped to 272,753 cu. m. (about 1,718,334 bbl.), a decrease of 8.5 per cent from July 1945. Total output for the first 7 months of this year was 1,916,285 cu. m. (about 12,072,596 bbl.), which is 10.3 per cent under production for a corresponding period in 1945.

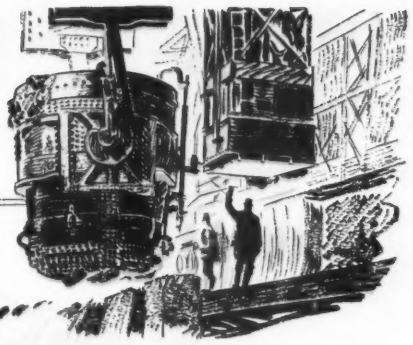
Pantepec Lease Authorized

CARACAS.—Stockholders of Pantepec Oil Co. of Venezuela have given the company permission to buy a major interest in leases on approximately 4,600,000 acres of Florida potential oil lands for $1,111,111.

Colombia Studies Council Bill

BOGOTA.—A bill creating a National Petroleum Council in Colombia has passed, with minor amendments, its first reading and will go next to the House for second reading and vote.

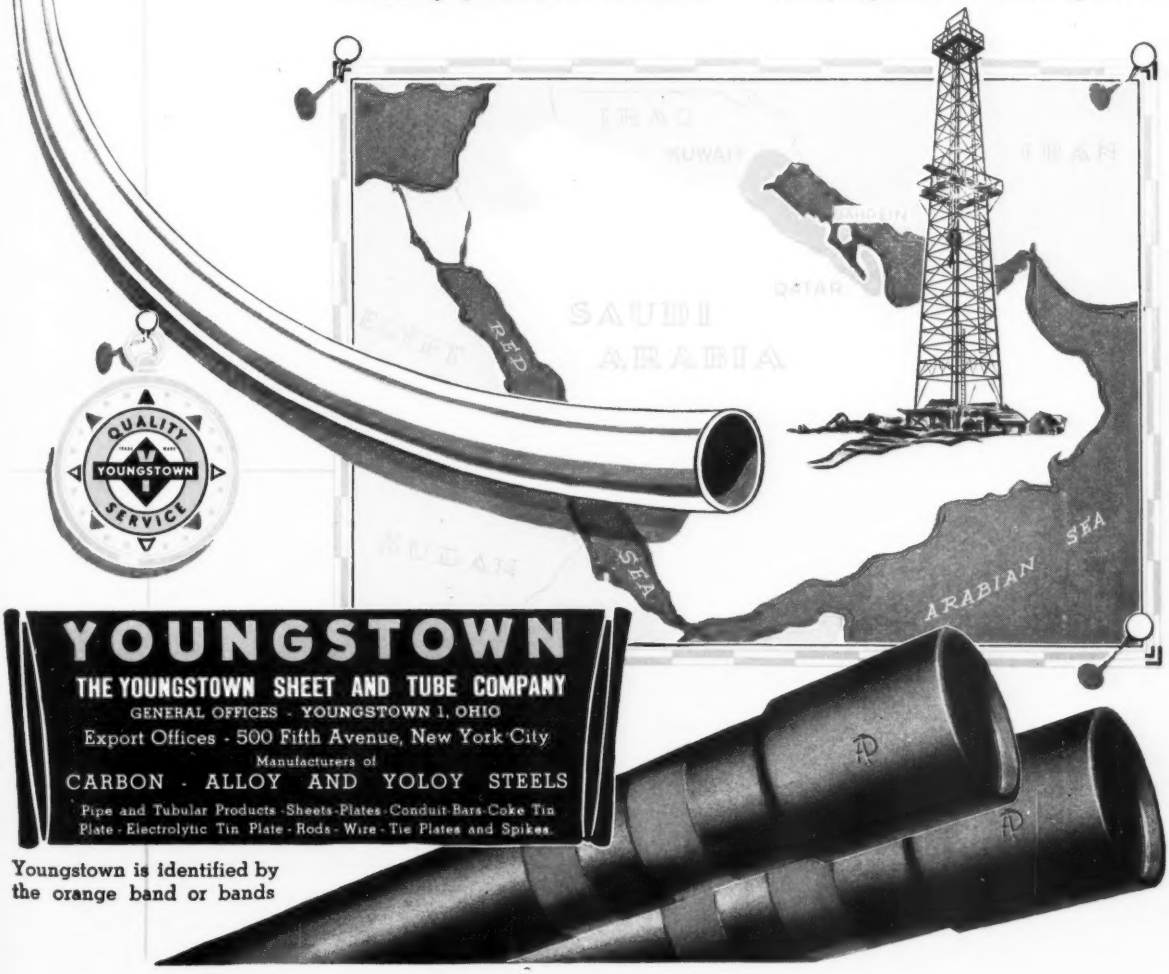
Youngstown to SAUDI ARABIA



SPEAK of undeveloped oil and the eyes of the world focus on the Near East. Four Western Countries control the oil rights in this area touching the Persian Gulf in which are located large proven petroleum reserves.

American oil companies own about 40% of the concessions. With interests in Iraq, Kuwait, Saudi Arabia, Bahrein Island, and Qatar, they are beginning to tap these vast resources. Only a beginning has been made. Present daily production in American operations is running less than that of the state of Kansas.

Youngstown Oil Country Tubular Goods is playing a part in the drama of this modern Arabian Night Entertainment--just as it has done in every oil-producing state and every other oil-producing area of the world. Wherever men find oil and are faced with problems of transporting materials for many thousands of miles to produce it only the best is acceptable. There they also find the orange-banded pipe from Youngstown, dependable for every need.



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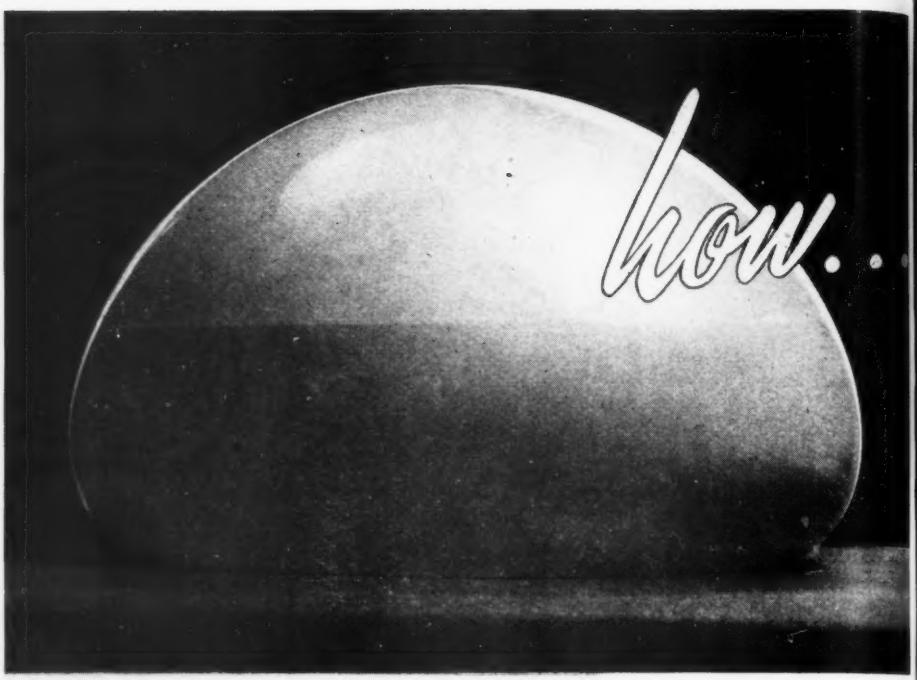
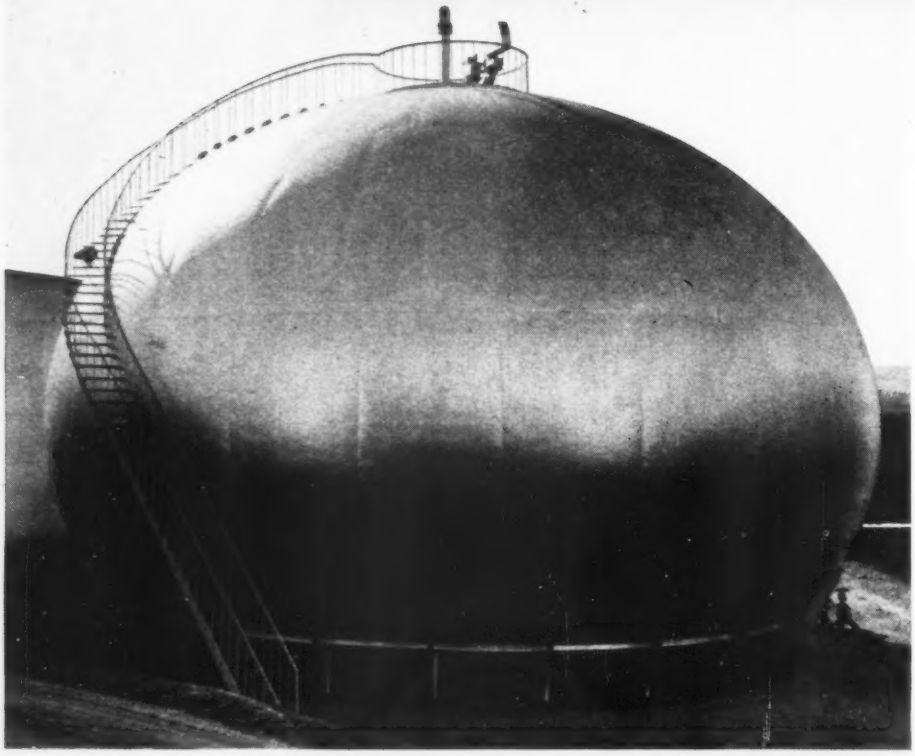
Youngstown is identified by the orange band or bands



THIS IS A RUBBER BALLOON PARTLY FILLED WITH WATER AND SUBJECTED TO A LOW INTERNAL PRESSURE . . . *When placed on a table it takes the form of a spheroid.*



THIS IS A 10,000-bbl. PLAIN HORTONSPHEROID . . . *Note the similarity in shape with that of the balloon in the photo at the top of the page. Greater efficiency is made possible through the use of this spheroidal shape.*

CHICAGO BRIDGE

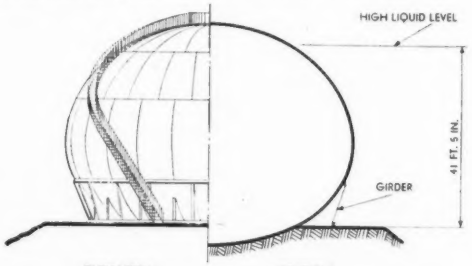
Chicago, 4.....2128 McCormick Bldg. Los Angeles, 14.....1423 Wm. Fox Bldg.
New York, 6...3347-165 Broadway Bldg. Atlanta, 3.....2154 Healey Bldg.
Cleveland, 15.....2204 Guildhall Bldg. Birmingham, 1.....1536 North 50th St.
In Canada: HORTON STEEL WORKS, Limited, FORT ERIE, ONT.

A RUBBER BALLOON HELPED DESIGN A PRESSURE STORAGE *tank*

. . . to give the oil industry the HORTONSPHEROID—an economical and efficient container for hydrocarbons ranging in volatility from motor gasoline to natural gasoline

the Hortonspheroid provides the user with many benefits not found in conventional storage tanks

- **ECONOMICAL CONSTRUCTION**—The shell plates are stressed in tension permitting maximum efficiency and economy in the use of the metal in the top and bottom plates. Another saving in material is realized since there is no inside framing.
- **FIRE PROTECTION**—The vapor inside is too rich to ignite.
- **EVAPORATION PROTECTION**—No loss can take place as long as the internal pressure does not exceed the setting of the pressure relief valve.
- **LOW OPERATING COST**—The Hortonspheroid does not require power to operate nor the service of an operator.



Elevation and section of a 20,000-bbl. Hortonspheroid designed for a pressure of 15 lbs. per sq. in. It is 66 ft. 8⅜ in. in diam.

Take an ordinary toy balloon, partially fill it with water and pump some air into it. Place it on a table and it will take the shape shown in the photo at the top of the opposite page. The liquid tends to flatten the balloon while the pressure tends to inflate it. In this form the "shell" stresses are uniform.

In designing the Hortonspheroid we put this principle to work. The bottom is curved and an outside ring girder is used to maintain the contour when the vessel is not completely filled or when the gas pressure is less than the design pressure. No inside framing is necessary in a smooth Hortonspheroid.

All of the plates in the shell of the Hortonspheroid, including those in the roof and bottom, are stressed in tension and are thus effective in resisting pressure. In an ordinary storage tank, the plates in the roof and bottom are not stressed and the cylindrical shell must be of sufficient thickness to resist the entire bursting force of the liquid. The savings in materials thus realized help to make the Hortonspheroid one of the most economical types of pressure storage tank available.

Plain Hortonspheroids have been built in capacities from 2,500 to 40,000 bbls. and for gauge pressures as high as 75 lbs. per sq. in. Noded type Hortonspheroids can be built in capacities up to 120,000 bbls. Write our nearest office for Bulletin E describing the Hortonspheroid in detail.

& IRON COMPANY

Tulsa, 3.....1606 Hunt Bldg. Washington, 4.....703 Atlantic Bldg.
Houston, 1.....5619 Clinton Dr. San Francisco, 11. 1254-22 Battery St. Bldg.
Philadelphia, 3. 1615-1700 Walnut St. Bldg. Detroit, 26.....1514 Lafayette Bldg.
Plants in BIRMINGHAM, CHICAGO and GREENVILLE, PENNA.

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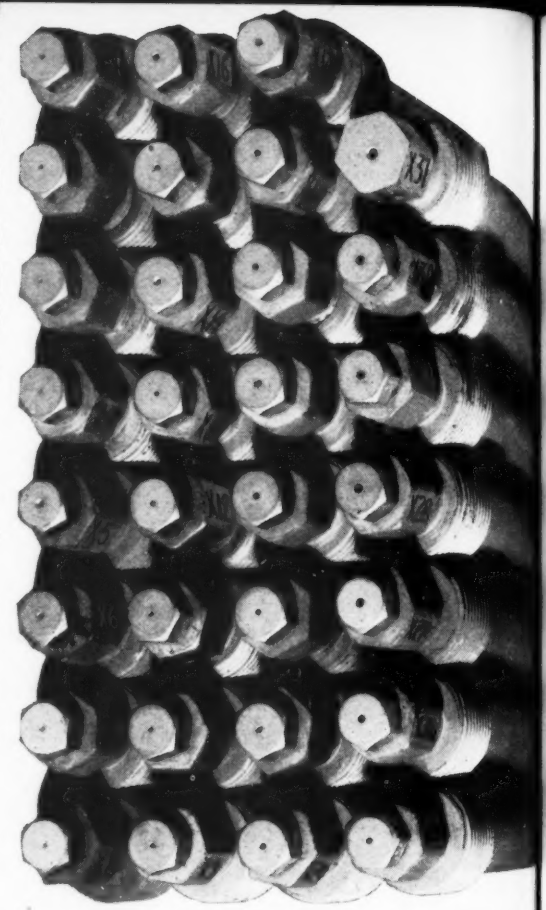
TRADE MARK REGISTERED

BELOW 1/8 INCH ONLY 8 SIZES OF BEANS AVAILABLE DRILLED IN INCREMENTS OF 1/64 INCH



BELOW 1/8 INCH 31 SIZES OF "X" BEANS AVAILABLE DRILLED IN INCREMENTS OF 10% OF FLOW

400% GREATER SELECTIVITY

in flow control

The above pictures provide a graphic demonstration of the relative range of selectivity between ordinary fractionally drilled flow beans and UNIBOLT "X" BEANS which are drilled in increments of 10% of well flow Whereas fractionally drilled beans, with their widely varying flow increments, are limited to eight sizes below 1/8 inch, "X" Beans offer nearly 4 times as many orifice selections in the same range. (Sixty sizes up to 1/2 inch). Obviously, the desired rate of flow from a given well can now be obtained with a high degree of precision

Already, numerous applications have been found for UNIBOLT "X" Beans on wells which produced either too much or too little through fractionally drilled beans. In practically all cases, an "X" Bean size is available to produce any given quantity of fluid or gas, without resorting to piano wire or other partial obstructions in the orifice

"X" Beans up to size "X-30" are furnished as economical renewable inserts. "X-31" and larger beans are standard full 6" length

Complete details are carried in the new Thornhill-Craver Catalog No. D-46. Write for a copy.

THORNHILL-CRAVER COMPANY

HOUSTON UNIBOLT THE ONE BOLT COUPLING TEXAS

WASHINGTON WATCHING

BY HENRY D. RALPH

Politics and the Big Inch

WASHINGTON.—The sudden interest in use of the big-inch pipe lines for emergency transmission of natural gas to the East is entirely of political origin.

The general public and many congressmen have the vague idea that natural gas would break the coal strike, or at least would be a thorn in the side of John L. Lewis and his United Mine Workers who have consistently opposed transmission of gas into coal-burning areas.

Chairman Roger Slaughter of the House committee investigating surplus property is very, very sore at the Truman administration because the President personally took a hand in the Kansas City primaries which caused Slaughter's defeat (following which the Democratic nominee was trounced by a Republican in the general election). His days as a member of Congress are growing short but the surplus-property investigation had not been able to pin anything embarrassing on anyone very high in the administration until he discovered (or thought he did) that the Interior Department had done nothing about emergency use of the big-inch. That is why he got so peeved when Secretary Krug wouldn't drop preparation of the government's court case against John L. Lewis to testify before the Slaughter committee on 2 hours' notice, and why he took the unprecedented step of issuing a subpoena for the cabinet officer.

The Applicants

The companies asking to use big-inch for gas this winter also have political, or at least not disinterested, motives. Three of them are bidders for the lines—Trans-Continental Gas Pipe Line Co., Big-Inch Oil, Inc., and Big-Inch Natural Gas Transmission Co. Obviously they would have an inside track for a purchase contract if they could get physical control of the lines, sign up gas producers and customers, and prove that gas use is feasible and economic. The fourth applicant, Tennessee Gas & Transmission Co., does not want the lines permanently but could use them very handily to augment its system during the winter peak. The T. G. & T. system crosses the big-inch, it has excess gas production beyond its transmission capacity, and many distributing customers in the Upper Ohio Valley area with mains crossing the big-inch right-of-way, all of whom could easily use more gas during the coming months.

Engineering testimony indicates that it is quite possible to "drift" 50,000,000 to 100,000,000 cu. ft. of gas per day through the big-inch lines and that connections with gas fields and distribution mains could be made within 2 to 4 weeks. However, this would be the heat equivalent of only 5,000 or 6,000 tons of coal per day—literally a drop in the bucket. Moreover, this gas would not actually replace any coal except in some manufactured gas plants that might be hooked up to the big-inch, and a few industrial consumers now equipped to burn either coal or gas. Natural gas could be used to enrich some coal gas but couldn't be substituted for it without alterations to all gas-burning equipment.

OGD's Coordinating Job

THE coal strike has given Interior Department's Oil and Gas Division its first opportunity to do the sort of intergovernmental coordinating envisioned by its founders. All last week OGD officials were in a huddle over emergency gas use of the big-inch pipe lines to get more fuel to shivering Easterners, calling in representatives from the Federal Power Commission, War Assets Administration, and other agencies, as well as the companies which want to move gas through the lines.

Witnesses before the Slaughter committee made it sound so simple to start gas moving through the lines that the chairman expressed amazement that it hadn't been done already. But there are not only economic and engineering, but also legal and political problems involved, and even in war time the Government had some trouble getting its many autonomous agencies to work together on an emergency program.

Among the questions OGD had to answer were whether WAA could and would permit interim use of big-inch pending final disposition, whether FPC could and would grant an emergency certificate for gas transmission, whether emergency use should be by the Government itself or by a private operator, whether a private operator should be one of the bidders or an established gas-transmission company, what the rental and rates should be, and how the gas should be allocated among customers.

OGD, of course, has no direct jurisdiction over any of these matters, but it is acting under authority of President Truman's letter suggesting that it serve as an instrument to coordinate government policy and serve as a single channel of communication between Government and industry in oil and gas matters.

Max Ball as OGD Head?

THE current fuel emergency may result in easing Max Ball into the job of director of the Oil and Gas Division.

For months Acting Director Ralph K. Davies has been asking Ball, petroleum consultant and author, to take the post, but he demurred on the ground that he was engaged in a big consultant job and didn't care much about working for the Government anyway. However, he let Davies understand that if no one else could be found for the job he might give it further consideration later on.

Now Ball has been called in as a special consultant to OGD in connection with emergency gas use of the big-inch pipe lines. During the latter part of the war Ball served with the Petroleum Administration for War and he prepared the presentation on PAW's achievements before the O'Mahoney committee of the Senate last year, so he is quite familiar with the way government wheels turn.

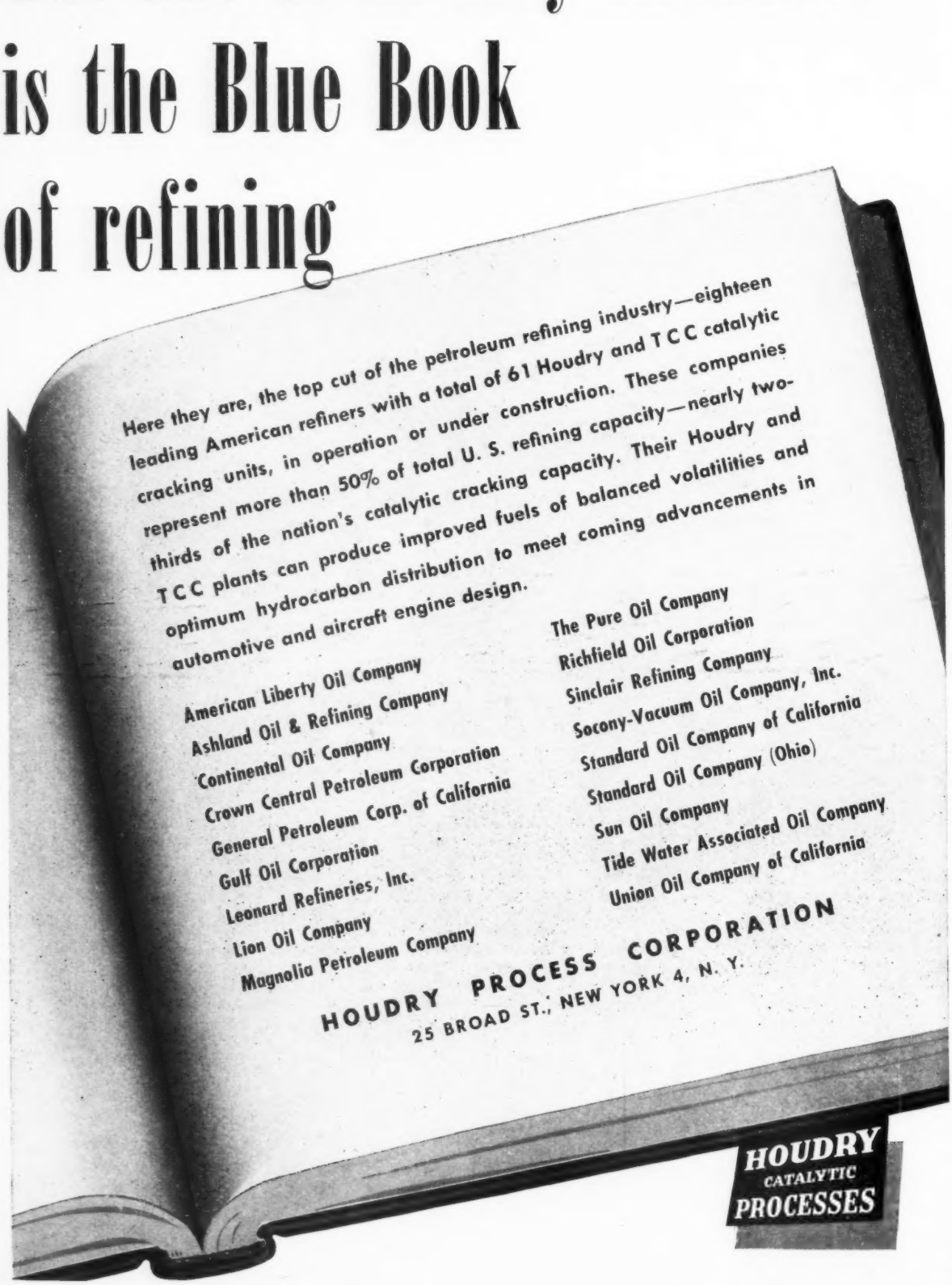
Now that Davies has got Ball's nose under the OGD tent he may be able to get him all the way in. However, if Ball does accept the position of director he probably would retain it only for a year or so, as it is understood he has a strong preference for private consulting work as against a permanent career in government.

The Elk Hills Contract

STANDARD OIL CO. OF CALIFORNIA is not expected to accept Secretary Forrestal's compromise proposal for amending the Elk Hills operating contract, though negotiations have not been formally terminated.

Standard asked an amendment to have the Navy pay two-thirds of the cost of conducting engineering studies in Naval Petroleum Reserve No. 1 and of maintaining the field in readiness condition. At present Standard pays it all, $600,000 per year, in return for the privilege of producing some 8,000 bbl. per day of its own oil. It has the option of declaring the "primary period" terminated, which would force the Navy to pay the entire cost, but any oil produced

The list of Houdry licensees is the Blue Book of refining


Here they are, the top cut of the petroleum refining industry—eighteen leading American refiners with a total of 61 Houdry and TCC catalytic cracking units, in operation or under construction. These companies represent more than 50% of total U. S. refining capacity—nearly two-thirds of the nation's catalytic cracking capacity. Their Houdry and TCC plants can produce improved fuels of balanced volatilities and optimum hydrocarbon distribution to meet coming advancements in automotive and aircraft engine design.
American Liberty Oil Company
Ashland Oil & Refining Company
Continental Oil Company
Crown Central Petroleum Corporation
General Petroleum Corp. of California
Gulf Oil Corporation
Leonard Refineries, Inc.
Lion Oil Company
Magnolia Petroleum Company
The Pure Oil Company
Richfield Oil Corporation
Sinclair Refining Company
Socony-Vacuum Oil Company, Inc.
Standard Oil Company of California
Standard Oil Company (Ohio)
Sun Oil Company
Tide Water Associated Oil Company
Union Oil Company of California
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would be from the Navy's share of the reserve.

Because the House naval affairs committee raised some question, Forrestal proposed to split the difference and assume about one-third of the cost. Other Navy officials don't expect Standard to accept this but they hope Standard will go on paying the money rather than throw the whole thing into the Navy's lap.

However, the affair is not closed. At the recent hearings Rep. Lyndon Johnson of Texas read a vicious attack on both the Navy and Standard, criticizing the original operating contract and the proposed amendment and implying that the public is getting a raw deal. This infuriated Standard, the Navy, and the rest of the committee, since the committee helped draw the original contract. The record is being kept open, and both parties to the contract intend to file answers to Johnson's blast, whether or not they can agree on an amendment to the contract.

On the NPC Agenda

THE program for the January 21 meeting of the National Petroleum Council will be drawn up by its agenda committee which Chairman George Hill, Jr., has called to meet in Washington December 10.

At the last council meeting Interior Department asked NPC to appoint committees on half a dozen subjects, but it deferred action on compilation of petroleum statistics, future availability of fuels for military aircraft, and a national oil policy regarding reserves, imports, and foreign operations. These matters will be before the agenda committee, together with any other subjects which may be proposed by the meeting date.

The council will receive reports from three project committees appointed at the September meeting dealing with the shortage of pressure tank cars, regulations for oil and gas leases on the public domain, and shortages of lead and other materials needed by the industry. The recently appointed nominations committee may or may not be ready with proposals for a permanent chairman and vice chairman; there appears to be a general disposition to delay such appointments in order to make Walter S. Hallanan continue as acting chairman.

The Tideland Legal Fight

THE original case of the United States versus the State of California involving ownership of oil-bearing tidelands along the Pacific Coast will probably be reached for argument by the Supreme Court early in February.

It is not expected that the case will be referred to a master in chancery to make a finding of fact, as is usual in suits filed directly in the Supreme Court, because this case is felt to involve a question of law only, with no dispute as to facts. Therefore a final decision may be expected during the spring.

The Government will throw all possible weight behind its claim to federal ownership of all submerged lands, and Attorney General Tom Clark may argue the case personally. Many other states are expected to support California's position that submerged lands have been under state jurisdiction since the formation of the Union and that some 50 previous Supreme Court decisions clearly support that view even though the court may not have said so explicitly and unequivocally.

Thus a Supereme Court decision may come before the new Congress gets around to taking action on a resolution to surrender any claim the federal Government may have. However, if the court says the Government has title, it would still be possible for Congress to cede all rights to the states, though the opposition to this legislation would be greater in the face of such a decision.

U. S. Chamber Opposes International Oil Control

CHICAGO. — Strong opposition to the creation of any international agency which might exercise control over the domestic petroleum industry was voiced here last week in a recommendation to the board of directors of the United States Chamber of Commerce.

Prepared by the fuels and energy subcommittee of a natural-resources department committee, the recommendation stated the Government "should itself refrain from entering directly or indirectly into the oil business."

D. J. Guy, manager of the natural-resources department, indicated further expressions of opposition will greet any attempts at government control over natural resources. The committee's recommendation was based on the idea that freedom of natural resources is the basis of this nation's economic structure.

The recommendation declared, in part:

"The chamber opposes all proposals for control by a federal bureau of production of petroleum and natural gas and is against all efforts, legislative or otherwise, to break the petroleum industry into separate parts such as production, refining, transportation, and marketing. Failure within states of proper application of conservation laws should not obscure accomplishments of the states and their determination to solve the problem through their own efforts.

"The Interstate Oil Compact has shown the value of state compacts as a means of conserving natural resources and contributing to the public welfare. It should have continued support."

The chamber group also voiced support of the vetoed tidelands bill which provided state ownership of tidelands and proposed an educational program to give the public the facts about the country's natural resources, including an informative bulletin on fuels.

Clark Will Address Oil Compact Dallas Meeting

DALLAS.—U. S. Attorney General Tom C. Clark will discuss petroleum as a factor in the national economy in making the principal speech at the winter quarterly meeting of the Interstate Oil Compact Commission here December 9-11.

Clark's address, on the closing day of the meeting, will follow presentation of technical papers keyed to the theme of reservoir control. Highlighting the addresses will be those by Don R. Knowlton, Oklahoma City consulting engineer and wartime director of production for Petroleum Administration for War, and Jack K. Baumel, chief engineer of the Texas Railroad Commission.

The compact's economic advisory committee was scheduled to meet in advance to study the current situation and prepare its report. An open forum December 10 is expected to feature discussion of public-relations plans, oil conservation payments, and the Anglo-American oil agreement.

Speaker at the Tuesday night banquet will be Robert L. Thornton, president of the Mercantile National Bank, Dallas.

September Petroleum Exports Show Decline

WASHINGTON.—Exports of crude oil showed a drop of nearly 20 per cent during the month of September, largely due to the maritime strike, according to a report of the Department of Commerce. September shipments totaled 3,687,000, a daily average of 122,900 bbl., against 4,602,000 bbl., or a daily average of 148,452 bbl., in August. The 1946 figure, however, still was above the total of 3,380,000 bbl., a daily average of 112,067 bbl., in September 1945.

Exports of gasoline and fuel oil in September totaled 2,722,000 bbl.—90,733 bbl. daily, showing a drop of 7.86 per cent under August shipments of 3,036,000 bbl., or 97,935 bbl. daily. Exports in September 1945 were 1,806,000 bbl., or 60,200 bbl. daily. Decrease in exports of all commodities during September was 27 per cent.

Expanded Electrification Program Predicted by P.E.P.A. Speakers

A BRIGHT future in the continued and expanded use of electric power in operations of the petroleum industry was predicted by speakers at the eighteenth annual conference of the Petroleum Electric Power Association this week in Tulsa.

The 2-day meeting featured a variety of talks on various phases of oil-industry electrification, and included technical discussions of its applications to the industry's pipe-line, producing, and refining branches.

In the opening session Tuesday morning, C. N. Robinson, vice president, Public Service Co. of Oklahoma, told the group that "many more jobs will be electrified in coming years because of the saving in labor costs and in the initial investment." In the next few years, he said, many more stationary engines will be electrified on the basis of a conservation of a natural resource and that fuel reserves should be used in mobile engines, he said. "The big-inch pipe lines did a good job of helping win the war, and they did it all with electric-driven centrifugal pumps," Robinson added.

Speaking on "Newer Electric-Power Equipment for the Oil Industry," B. M. Brown, manager, petroleum and chemical section, industrial-sales department, Westinghouse Electric Corp., East Pittsburgh, Pa., reviewed developments to improve equipment "so as to give lower maintenance, more efficient service, and the utmost in reliability."

Large Drilling Well

Brown pointed out increased depth of drilling, the necessity of conducting operations in inaccessible locations, and other considerations has brought about the development of large engine-driven d.c. drilling rigs for both land and barge operations. He said a drilling rig powered by internal-combustion engines and now in operation has a total generating capacity of 1,200 kw.; the draw works motor rated 800 hp.; the main mud pumps, 500 hp.; and the table, 300 hp.

"In order to more efficiently handle large blocks of power and obtain the most in flexibility and reliability from such a rig, it has been necessary to devote considerable time to the development of simple yet flexible and reliable control schemes," he said. "Our ultimate objective in this case is to arrive at an electric drilling rig where the driller might well sit at an operating desk and have full control of all the operations of his drilling rig with a minimum of physical effort."

Brown said one difficulty in the application of electric drilling rigs has been the general unfamiliarity of crews with the equipment. This is being overcome, he added, by the more extensive use of electrical power for auxiliary equipments on steam and mechanical drilling rigs and by the wider understanding of the possibilities of electric power gained by former service men during their military careers.

The use of electric power for oil-well pumping, Brown said, is increasing, and "we expect that it will be more widely used because of the extension of high-line power to isolated leases and the improvement in electrical distribution systems through the use of better lightning protection and self-protecting transformers. . . . Another development which is going to contribute to lower maintenance costs on electric pumping installations is the more widespread use of motors with prelubricated ball bearings. These bearings, prelubricated for a minimum of 5 years' service, will eliminate the many difficulties experienced because of improper greasing."

Electric Power in Refineries

As for electric power in refineries, the Westinghouse official said its more extensive use and the increased size of refineries has made necessary the devoting of considerable attention to the concentration of power in distribution systems. "To handle safely the great blocks of electric power used in process areas, we have developed switch gear having high interrupting capacity and at the same time built for safe and reliable operation. . . . We already have oil-immersed switch gear, motor starters, etc., which could interrupt 50,000 kva. on circuits up to 5,000 volts. Today we are building completely oil-immersed vertical-lift switch gear for incoming line circuits, feeder circuits, and motor-starting circuits with an interrupting capacity of 100,000 kva."

In refineries and chemical plants, larger-size and synchronous motors for hazardous locations have been developed as the amount of material processed and the required pressures have increased, Brown continued. Some of these included explosion-proof motors with the Underwriters' label up to and including 1,000 hp., 3,600 r.p.m.; slow-speed engine-type synchronous motors; and "unusual motors" built with special housings and heat exchangers and allowing the motor to be filled with inert gases or pressurized gas to eliminate explosive hazards or reduce maintenance because of corrosive atmospheres. A wider use of factory-assembled, explosion-proof control centers is a definite likelihood, he continued, and the use of fuses to obtain a high interrupting capacity on high-voltage starters has become more common.

"Almost all of the long-distance pipe lines constructed during the war used motor-driven pumps and the experience developed in the use of electric motor-driven equipment has indicated that electric pumping can be used advantageously on both crude-oil lines and products lines. . . ." Brown said. "Looking into the future we may contemplate the use of higher pressures with greater spacing between stations, which will consequently reduce the number of pumping stations with corresponding decreases in total cost of buildings equipment, power procurement, and operating labor. This means higher horsepower per station with a portable increase in motor size."

Producing Oil Fields

Another speaker at the conference was J. N. Poore, Dallas, of the industrial division of General Electric Co. In a talk on "Electrification of Producing Oil Fields," he discussed the selection of the proper type of distribution system for field pumping and a suggested method of laying out these systems. He also presented general data on how to arrive at estimating costs for distribution system.

B. F. Thompson, Tulsa, Public Service Co. of Oklahoma told the conference that development of a practical variable-stroke reciprocating pump "has placed a valuable new tool in the hands of the engineer designing pipe-line pumping stations, particularly if his design contemplates the use of electric motors of automatic operation."

The pump is the Aldrich-Goff variable-stroke pump. The constant speed of electric motors has in the past limited the flexibility of electrically operated pumping stations, Thompson said, but the new pump completely removes this disadvantage and through its possibility of automatic operation adds to the flexibility of the pipe-line system.

"It is probably too early to predict the extent to which the variable stroke pump will be utilized in the future by the pipe-line industry," he said, "but at present it would seem that its prime field of application is the main-line stations of small to medium-sized crude and products lines, leaving the large high-capacity lines to the centrifugals, the very small lines and the gathering lines to the reciprocating pumps."

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More Increases Are Made In Prices of Products

STILL responding to the recent crude oil advance, petroleum markets continued their upward trend on the East Coast and in the Midwest last week where fractionally higher prices were posted on most products.

In New York, Socony-Vacuum Oil Co., Inc., followed earlier raises in some fuel oil prices with an increase in its gasoline quotations. Standard Oil Co. of New Jersey announced price advances for heating oils and motor fuel. Standard Oil Co. (Ohio) in Cleveland posted an advance in its gasoline prices, and prices on heating oils in the general Mid-Continent area went up another ⅛ cent.

Effects of the lengthening coal strike were beginning to be felt in oil markets. Residual was reported tight on the East Coast with many coal users converting to oil. One large industrial consumer was said to be buying 15,000 bbl. more per day than previously.

In the Mid-Continent area, one marketer said inquiries were being received from eastern utilities and steel mills for heavy fuel oil. Another marketer, however, said he had noted no frantic calls such as were received in last spring's strike.

In New York reports were heard that the Government is planning to take more tankers out of its reserve and place them in the coastwise fuel-oil trade. In Washington, Ralph K. Davies, acting director of the Oil and Gas Division of the Department of the Interior, reassured fuel-oil users that the supply is adequate. He pointed out fuel-oil stocks east of the Rocky Mountains are about 10,000,000 bbl. above the total a year ago.

Socony-Vacuum's gasoline price increase was 0.2 cent per gallon except in some western New York points where the increase was 0.3 cent. Its earlier increase on No. 2 fuel oil was 0.3 cent per gallon in New York, and from 5 cents per barrel on No. 5. Jersey Standard's increase on motor fuel, kerosene, distillate and heating oils effective November 30 was 0.3 cent per gallon. Ohio Standard's gasoline advance amounted to ½ cent a gallon. The announcements of Ohio Standard and Jersey Standard said the increases reflected the new crude prices.

Market sources in the Mid-Continent area regarded still another ⅛ cent rise in burning-oil prices as a possibility. The second ⅛ cent rise last week placed 42-44 kerosene at 5⅝ cents, range oil at 5⅛ cents, and No. 2 at 4¾ cents. Little if any burning oil was reported going at under-the-market prices. Mid-Continent motor fuel was reported steady at existing prices after some of its earlier weakness disappeared following the crude increase.

Natural gasoline in the Mid-Continent area was still extremely tight at the prevailing price of 5 cents in Oklahoma. The North Texas market stood at 4¼ cents. Many suppliers were not quoting because of the lack of spot-market material. One supplier pointed out the natural-gasoline market is geared to the main motor-fuel market and that the price will hold where it is economical for refiners.

The bulletin of the National Association of Purchasing Agents said last week that, based on authoritative sources, there is a comparatively small quantity of Bunker C oil available to replace the normally coal-burning installations caught without an adequate coal inventory.

"While No. 5 oil is somewhat more plentiful than during the coal strike last spring, the available quantities are still limited," it said. "This means that the only really available fuel oil substitute for soft coal will be No. 2 heating oil, and with that costing in the neighborhood of $3 a barrel and up, it will prove an expensive substitute for soft coal, based on a rough figure of 4 bbl. of fuel oil as the equivalent of 1 ton of coal."

Research to Be Discussed At Dallas A.C.S. Meeting

DALLAS.—More than 40 scientists from the laboratories of industry, education and government will address a regional meeting of the American Chemical Society here December 12-13 on research progress in petroleum, synthetic rubber, insecticides, and many other fields of chemical science and technology.

Speakers from the petroleum industry will include: James A. Anderson, Jr., Baytown, Tex., Humble Oil & Refining Co.; L. G. Sharp, E. R. Boedeker, R. J. Herold, A. G. Oblad, Nelson P. Stevens, and Rodney M. Squires, all of Dallas, and E. J. Reeves, Beaumont, all of Magnolia Petroleum Co.; H. N. Frost, C. A. Murray, F. R. Clegg, and W. E. Norris, all of Pure Oil Co., Nederland, Tex.; J. N. Stewart, Beaumont, N. B. Haskell, and J. A. Redlinger, Port Arthur, Tex., and D. V. Lyttleton and R. N. Traxler, Port Neches, Tex., all of The Texas Co.; W. L. Hiller, Jr., and A. R. Rescorla, of Cities Service Refining Corp.; and C. E. Starr, Jr., J. S. Anderson, and V. M. Davidson, all of Standard Oil Co. of New Jersey, Baton Rouge.

Outline of Tax Trends Will Highlight Forum

SAN ANTONIO.—Discussion of state and local tax trends will highlight the annual ad valorem tax forum of the Mid-Continent Oil and Gas Association here December 16-18, according to Marshall L. Edwards, Skelly Oil Co., Tulsa, chairman of the forum.

Sessions of the forum will be held in the Plaza Hotel roof garden. Speakers include Charles C. Zatarain, member of the Louisiana Tax Commission; E. L. Maynard, supervisor of the property-tax division of the Illinois Department of Revenue; W. H. Wallace, valuation engineer for the Mississippi Tax Commission; J. R. Robertson, chief engineer of the Indiana State Board of Tax Commissioners; and Dr. F. H. Guild, director of the research department of the Kansas Legislative Council.

Waste Order Issued

BATON ROUGE, La.—The Louisiana Stream Control Commission last week ordered all oil companies in the coastal area to halt dumping oil-well wastes into streams or the Gulf of Mexico. The order followed complaints of damage to oyster beds estimated at $6,000,000. Observers expected companies to appeal the decision.

DEATHS

Paul Malloy, 25, drilling contractor associated with Richard Kennedy, Pampa, Tex., died November 30 in an automobile accident in Tulsa where he was spending the holiday weekend.

Carl J. Waage, 52, manager of marine sales at Seattle for General Petroleum Corp., died November 17. He came to this country in 1918 from Norway.

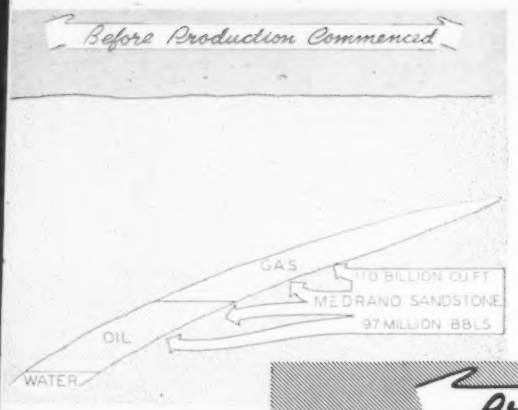
Asa P. Davis, superintendent of transportation of the Dallas division of Sun Oil Co., died November 25 in Dallas.

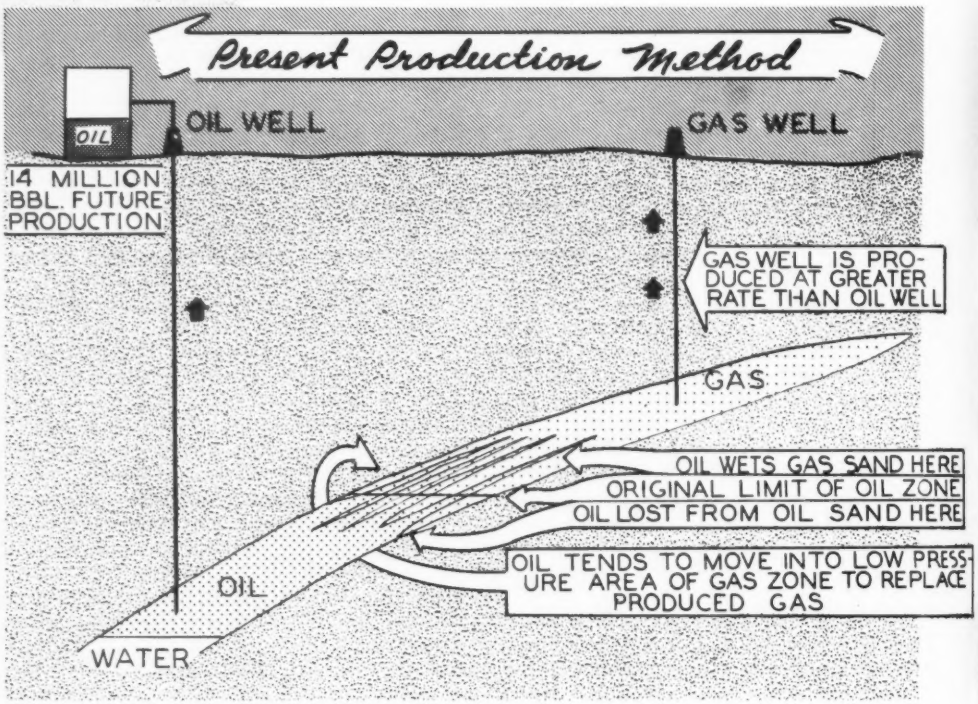
John Bemis Woodward, 73, Bradford, Pa., independent producer, died November 24 in Bradford.

Paul M. Pope, Sr., 65, president of Apex Oil Corp., died November 28 at his home in Houston. He was a well-known independent oil operator in Texas, Oklahoma, Louisiana, and Florida.

Proposed Unitization and Pressure Maintenance May

by Kenneth B. Barnes




Present Production Method
OIL
OIL WELL
GAS WELL
14 MILLION BBL. FUTURE PRODUCTION
GAS WELL IS PRODUCED AT GREATER RATE THAN OIL WELL
GAS
OIL WETS GAS SAND HERE
ORIGINAL LIMIT OF OIL ZONE
OIL LOST FROM OIL SAND HERE
OIL TENDS TO MOVE INTO LOW PRESSURE AREA OF GAS ZONE TO REPLACE PRODUCED GAS
OIL
WATER

The "Before," "Present" and "Proposed" for the West Cement reservoir are shown in these three drawings. The reservoir is ideal for applying modern recovery practices—as the structure is steep, the sand uniform and thick, and with a big gas cap above the oil and flank water below (see above). Due to discovery and producing part of the gas zone first, then later developing the oil zone—and all on separate leases by many operators — the present production method (right) has shortcomings. What the proposed plan will do is shown by the third drawing (extreme right)

EVENTUAL attainment of possibly 300 per cent additional oil over that obtainable by present conventional practices is indicated in an extremely significant unitization and pressure - maintenance program in Oklahoma. This program, projected for the West Cement Medrano sand pool, and for which the detailed engineering and operating plans have just been completed, is located in Caddo County, approximately 75 miles southwest of Oklahoma City.

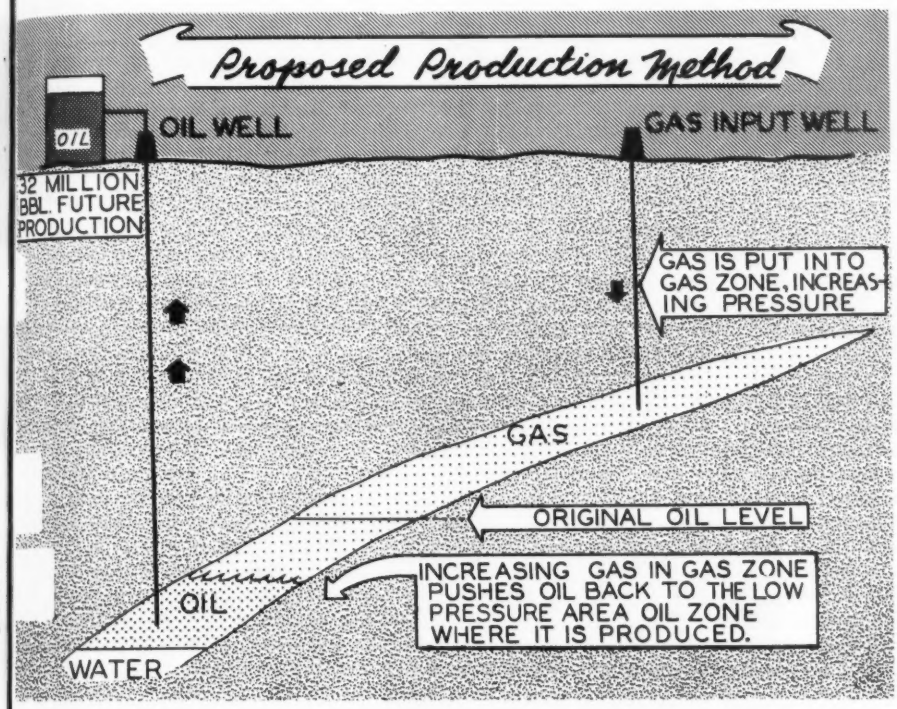
Engineers of the companies interested have conducted continuous investigations and studies of the reservoir conditions for more than 3 years, virtually from the time of the discovery of the oil-zone portion of the pool, in formulating the proposed project. A great deal of care has been taken in the studies. The very considerable expenditures, both of time and money, have resulted in a wealth of geological and engineering data being available. Most of the Medrano sand wells were cored and analyzed, all wells electric logged, and a number of bottom-hole crude and gas samples and pressure surveys taken. All these data have been carefully analyzed in building up the final program, which involves complete unitization of the reservoir and the inauguration of gas-injection activities coupled with efficient control of future oil production. Both the gas-injection and future production-control work, of course, will be made possible only through the unitization plan. Presentation of the unit plan will be formally made before the Oklahoma Corporation Commission on December 9.

Unusual significance may be attached to the West Cement unit program because it will be the first unit program in Oklahoma formulated and operated on the basis of an entire reservoir. There are other unit operations in Oklahoma, but none cover the whole reservoir, and with the exception of the South Burbank unit, in none are the royalty interests consolidated. Where the royalty interests have not been consolidated, the so-called units in Oklahoma, therefore, have been but merely little more than partnership operations, and the production has had to be taken from the separate leaseholds without regard to obtaining advantage of existing reservoir conditions and thus securing maximum recovery.

In the West Cement Medrano reservoir, approximately one-half of the total productive volume comprises a dry gas zone at the top of the structure while the other half volume comprices an oil zone. Altogether there is a total of 72 different leases covering the gas and the oil zones. Some of the leases are entirely within the gas-zone area, others are entirely within the oil-zone area, and some leases extend over both. Under the proposed program all leases will be consolidated to form a single operating unit or producing entity covering the entire reservoir. This will make possible a plan of operation in which the application of sound engineering principles will result in a tremendous increase in future oil production. Such

Treble Oil Production

in West Cement Pool

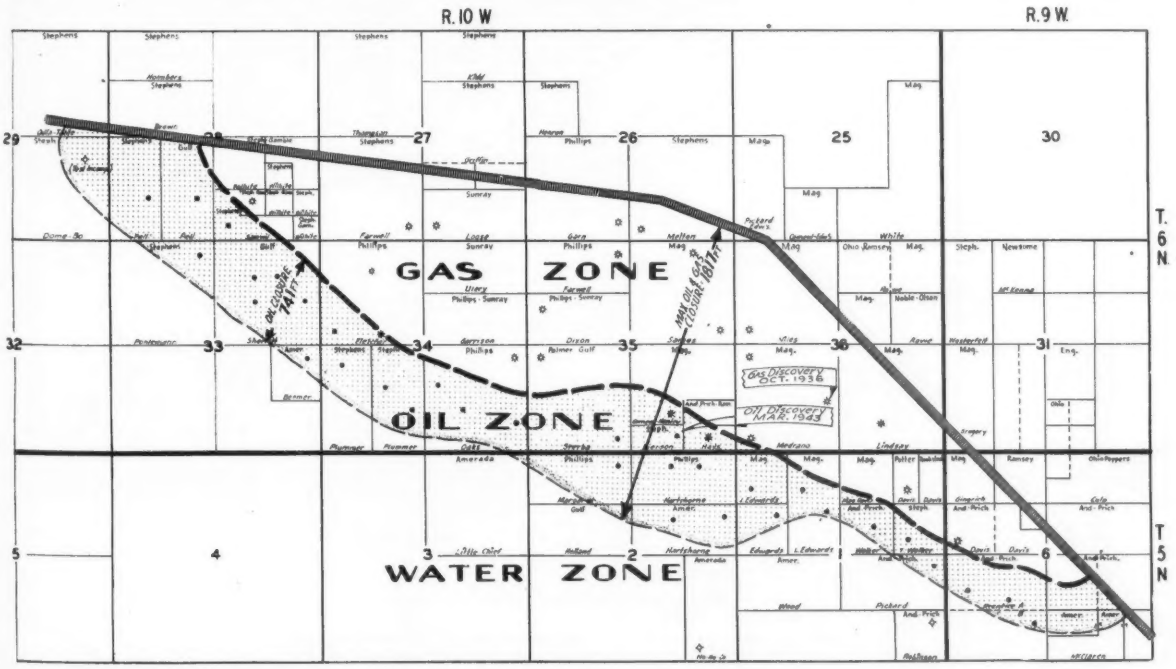

Proposed Production Method
OIL
OIL WELL
GAS INPUT WELL
32 MILLION BBL. FUTURE PRODUCTION
GAS IS PUT INTO GAS ZONE, INCREASING PRESSURE
GAS
ORIGINAL OIL LEVEL
INCREASING GAS IN GAS ZONE PUSHES OIL BACK TO THE LOW PRESSURE AREA OIL ZONE WHERE IT IS PRODUCED.
OIL
WATER

an application would be impossible under the present multiplicity of leases and operators.

Under present competitive methods of operation at West Cement, gas is being withdrawn from the gas wells in the gas-cap zone at a rate of 23,626 M.c.f. per day, which volumetrically is approximately five times that of the oil withdrawals of 5,200 bbl. per day from the oil zone. Unfortunately, this practice has resulted and is resulting in the migration of oil into the gas zone where it is wetting the gas sand and thereby becoming unrecoverable and lost to future production (as under present operating practices). Not only will the unit plan eliminate such future losses, but gravity segregation, together with gas injection on the crest of the structure, should in the future allow some of this otherwise "lost" oil to be recovered by oil wells located lower on the flank. Of greater importance, however, will be the additional large oil recoveries following the shutting in of the gas zone and the injection of additional gas for pressure maintenance. Outstanding examples of sim-

(Continued on page 98)

Below—Idealized structure and "saturation" map. Well depths vary from 4,348 to 6,280 ft.



Burnett Apparatus Used for

Gas-Deviation Determinations

by Earle N. Armstrong*

CONTRACTS for sale of large volumes of natural gas at pressures from 500 to 1,000 psig. to and by the large gas pipe-line companies have, in many instances, required periodic tests to determine deviation of the gas from Boyle's law. Several operating pipe-line companies have built apparatus of the Beckman type for such determinations. This apparatus requires very precise measurement of many small volumes and pressures, and is difficult to operate.

When Tennessee Gas & Transmission Co. started operation in October 1944, it had decided to use the newer type Burnett apparatus, copied from a design developed by Dr. E. S. Burnett of the U. S. Bureau of Mines at Amarillo, Tex. This design was chosen for T. G. & T. by the author of this article who was formerly with the U. S. Bureau of Mines, because the test data required the precise measurement of pressures only, and gave promise of being relatively easy to operate for a high degree of accuracy.

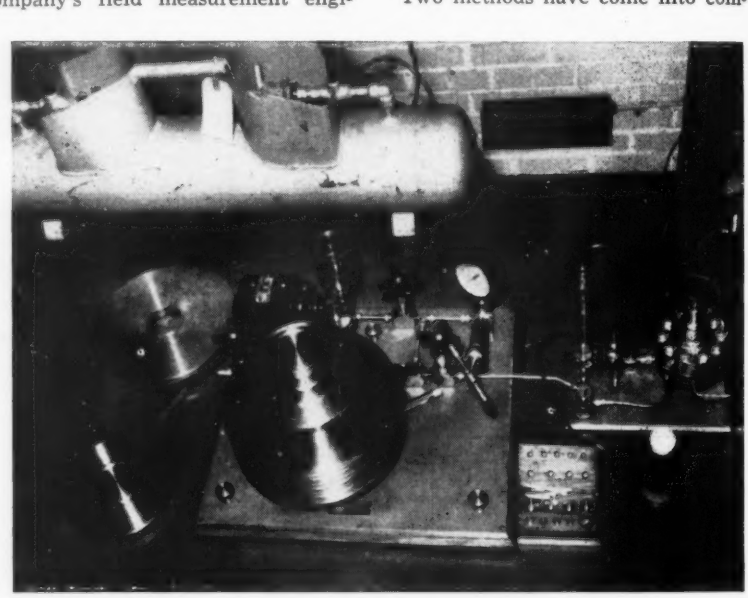
The Burnett apparatus has proved entirely satisfactory in our use. The company's field measurement engineers, E. S. Plank, C. M. Carter, and Ed Miller, have made witness tests with Ray Hitchman, John Overbeck, Charles Moorhead, Milton Crane, Gerald Hollis, Roy Schuster, and Arnold Hegwar, engineers and measurement superintendents representing the sales and producing companies.

The description of the Burnett apparatus and comments on its use have been drawn from the experience of the past year with the test work.

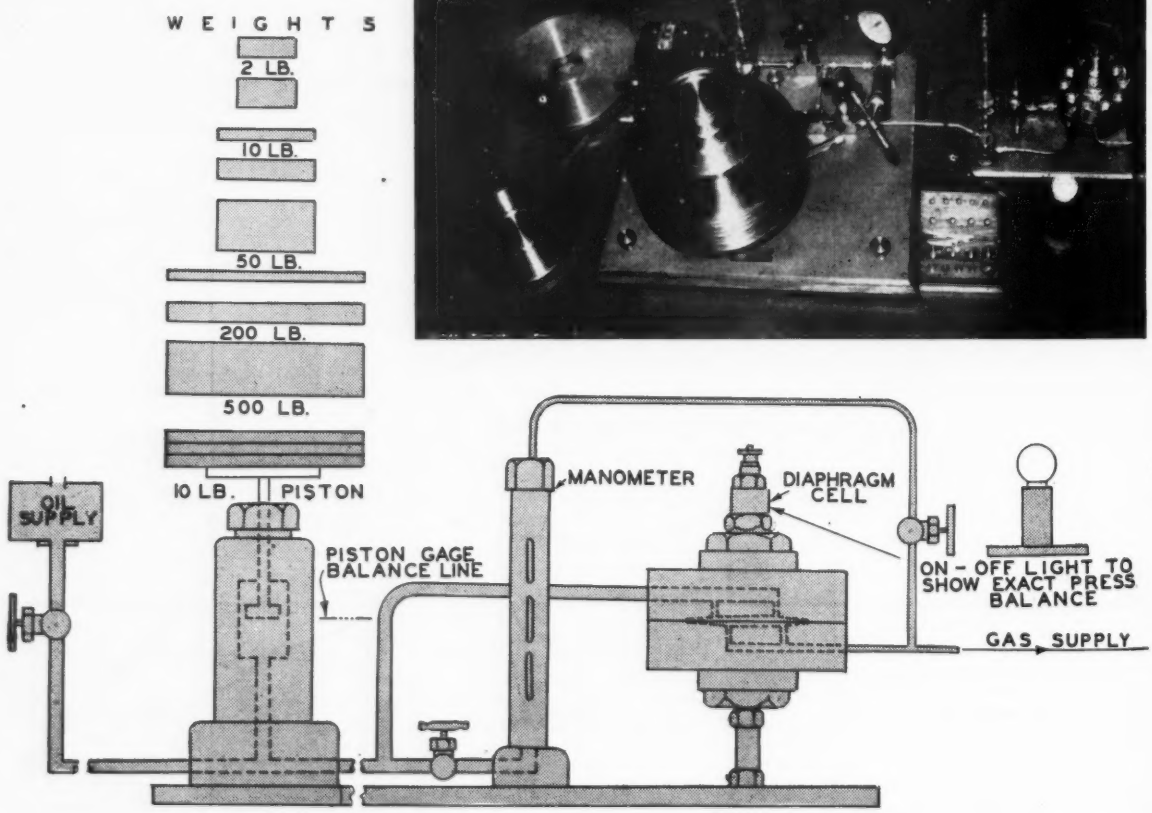
Methods of Determining Deviation

Two methods have come into com-

*Superintendent, gas measuring department, Tennessee Gas & Transmission Co., Houston.



This is a close-up photo and schematic drawing of the dead-weight piston gage and pressure-balance cell. The latter separates the oil of the piston gage from the gas sample in the test-chamber system



mon use to evaluate the deviation from Boyle's law:

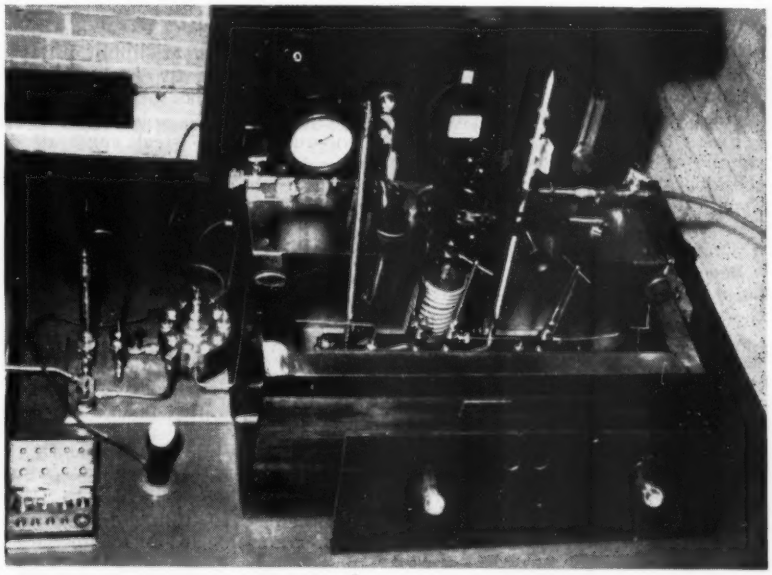
1. The chemist's method, using low-temperature fractional analysis of the gas and computing the deviation by use of deviation values for pure components. This method often disregards small amounts of carbon dioxide, nitrogen, helium, sulfur compounds, water vapor, and other gases not determined by the normal low-temperature fractional analysis. It is expensive, but is widely accepted in gasoline-company work because the fractional analysis serves other purposes.

2. The physical test method which makes direct test of the deviation of the gas from Boyle's law.

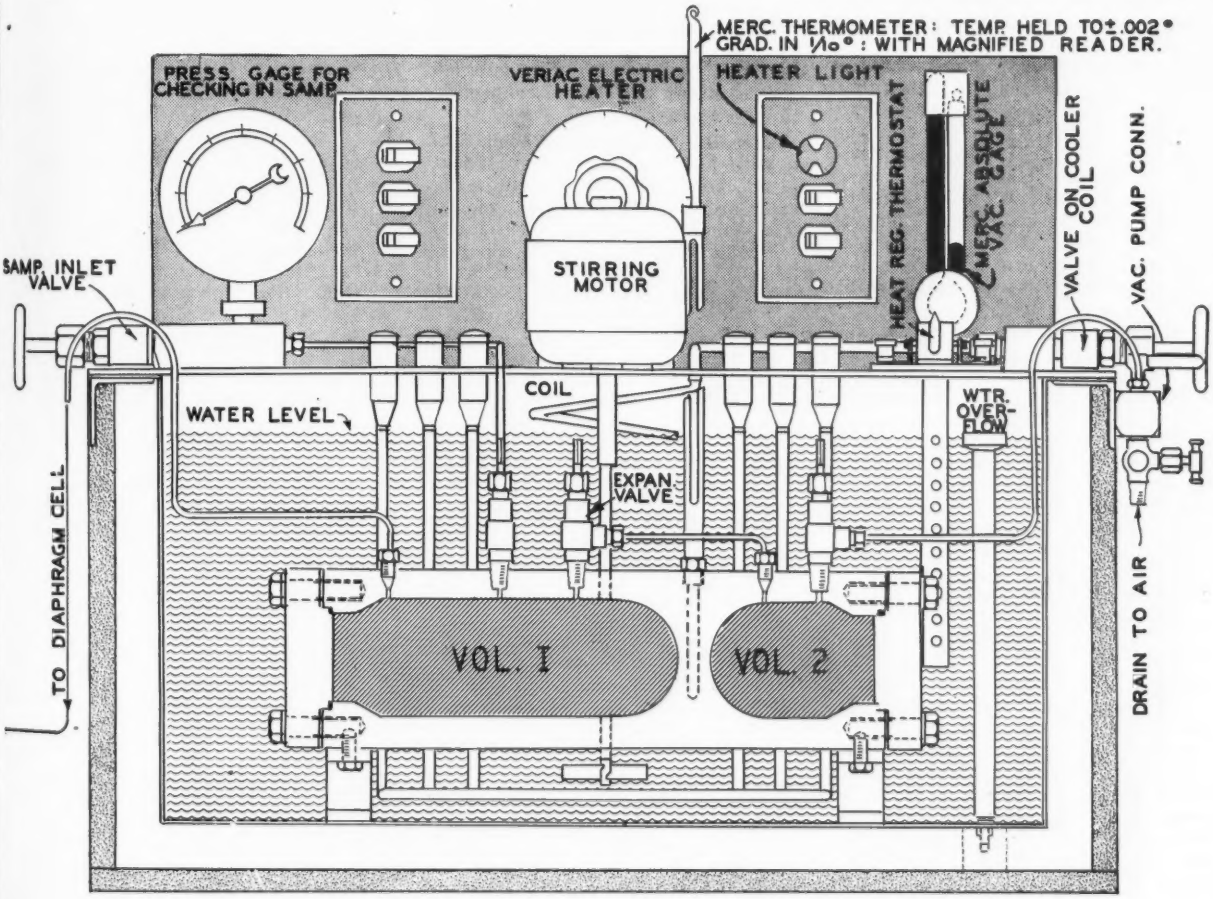
Two types of apparatus have been designed for direct testing. Bureau of Standards engineers designed an intricate test set which was built and operated. This apparatus was improved by Beckman of Pacific Gas & Electric Co., but still requires the measurement of a large number of small volumes of gas, which involves conditions difficult to accurately control. Pressures must also be measured, and the use of a large glass water bath is required.

The results of tests made with this apparatus are those summarized and published by the California Natural Gasoline Association in 1936.

During the 1930's, Dr. E. S. Burnett of the U. S. Bureau of Mines at Amarillo, became convinced that deviation for natural gases could be evaluated more accurately by pressure ratios alone, and he worked out many tests and finally turned out a finished apparatus designed to operate at very



Schematic drawing of constant-temperature water bath and the two expansion chambers, together with close-up view of the actual unit



accurately controlled constant temperature and equipped with a highly accurate dead-weight piston gage sensitive to pressure changes of 0.02 lb. He also devised a method for relating the pressure ratios by part calculation and part graphic method, which simplified the computation of test data.

Securing a Representative Gas Sample

The work of determining the deviation of natural gas from Boyle's law, in common with many other gas tests, divides into two principal parts.

First, to secure a representative sample of the gas and to get it into the laboratory, or better, into the test apparatus, in a manner which is truly representative of the gas under conditions in the pipe line.

Second, to run the tests with accurate, clean test equipment so that the results can be depended on.

Our experience with sampling leads us to emphasize the need for more than usual attention being given to taking and handling the gas samples, for deviation testing, both in the field and in the laboratory. We have learned two things by instruction and by bitter experience:

1. The gas sample must go into the sample tank or bomb very slowly and completely guarded against drawing in any condensed liquids, either water or hydrocarbons, which may have accumulated in the connecting valve or on the inner walls of the pipe line.

2. The gas sample must be held at temperatures equal to or higher than the temperature at which it was flowing in the line. We agree with and will quote from C.N.G.A. Bulletin TS-354, Paragraph 20, where it says:

"Accurate deviation tests cannot be run on a condensable gas (either water or hydrocarbon material condensing) at full line pressure unless test temperature is as high as the source temperature."

In field terms, if the gas in the pipe line is at 57° F., then samples must be taken from the flow through connections and into tanks which are at or above 57° F. In short, a warm day in the winter with air temperatures equal to or above ground temperatures, is the best time to get deviation test samples, if it is desired to run tests at 45° F. and up.

We think, too, that sample tanks should be warmed to the same temperature at which tests will be run before samples are drawn from the tanks into the test apparatus. It is desirable, therefore, to start the deviation test runs on the lower temperatures and advance to the higher temperatures. The object is to avoid reducing the temperature on the sample tanks at any time to temperatures below which the sample was taken, since it is necessary that any condensation at any time be avoided in the sample tanks. Care must also be taken to avoid conditions on the apparatus which will cause condensation between test runs.

We have settled on the following procedure for taking samples in the field:

A copper tubing manifold is made up, through which the gas can flow to each of four sample tanks. This insures the same composition of gas at the same pressure and temperature in all tanks, and the four tanks give us an adequate supply of gas at a high pressure for each test run. Our sample tanks are 6 by 36-in. seamless pipe with welding cap heads. One-quarter-inch steel angle needle valves are mounted near each end of the tank with light metal guards and a handle between.

The sample should be taken from a vertical connection and over the center of the line, if possible, so that no trapped condensables are drawn into the sample line. The connection should be blown at full flow for 30 seconds. The temperature of the gas in the line must be determined. Ground temperature at line level will serve if the gas pressure has not been compressed or reduced nearby. Satisfactory samples are best insured by filling the tanks very slowly. After several (5 to 10) fillings at low pressure, say to 100 lb., to insure purged tanks, then 40 minutes to 1 hour should be spent bringing the tanks up to pressures around 1,000 lb. Copper tubing should be used rather than pipe. The essential idea is that condensable liquids must be guarded against in any part of the connecting tubing or tanks.

After the samples have been shut in with plugged valves, they should be checked for leaks without using water around the valves and moved to the laboratory promptly. The tanks should be kept as warm as the line temperature at which they were filled at all times. This precaution can be neglected if the weather and laboratory temperatures are above the temperature of the gas supply from which the samples were taken.

When samples are to be flowed into the deviation test set, we place a coil of copper tubing upon an electric hot plate. The coil starts from a tank of compressed air. The copper tubing serves as an excellent exchanger, giving hot air for drying out all valves, connecting tubing, and the test apparatus before starting a test run. A ⅛-in. nipple packed with cotton is used just ahead of the test apparatus valves to insure clean gas flows. Flows from sample container to test set are made slowly.

A schematic, sectionized drawing of the Burnett apparatus is shown in the accompanying drawing.

Description of Burnett Apparatus

An apparatus for the determination of deviation designed by Dr. E. S. Burnett, Cyrogenic Laboratory, U. S. Bureau of Mines, Amarillo, was selected for use by our company as it gave promise of being more accurate and easier to operate.

The principle and application of this apparatus are described in an article in December 1936, Journal of Applied Mechanics, titled "Compressibility Determinations Without Volume Measurements," by E. S. Burnett, senior mechanical engineer, U. S. Bureau of Mines, Petroleum and Natural Gas Division, Amarillo.

After several years of testing work, a compact apparatus was designed and built at the Amarillo helium plant. This apparatus was demonstrated at the oil exposition at Tulsa and later was loaned to Refinery Supply Co. at Tulsa, who copied and built a duplicate for Tennessee Gas & Transmission Co.

An accompanying illustration shows

(Continued on page 114)

TABLE 1—NATURAL GAS DEVIATION LABORATORY TESTS

	P_0	P_1	P_2	P_3	P_4	P_5	P_6	P_7
Time begun	8:00	9:05	9:30	9:55	10:19	10:44	11:10	11:37
Time read	9:01	9:25	9:50	10:17	10:39	11:04	11:31	12:00
Interval	1:01	20	20	22	20	20	21	23
Barometer:								
Temperature	78	78	78	78	78	78	78	78
Reading (in.)	30.110	30.110	30.110	30.110	30.110	30.120	30.100	30.100
Correction	.134	.134	.134	.134	.134	.134	.134	.134
Net total	29.966	29.976	29.976	29.976	29.976	29.986	29.966	29.966
Factor	2.036	2.036	2.036	2.036	2.036	2.036	2.036	2.036
Reading (lb.)	14.72	14.72	14.72	14.72	14.72	14.73	14.72	14.72
Table	10	10	10	10	10	10	10	10
Weights	500	200	200	200	100	50	50	20
	100	200	100	10	20	20	10	10
	2	20	2	.20	20	20	.2	2
	2	10	1	.20	2	2	.12	2
	.5	1	.5	.10	1	2		1
	.2	.2	.12		0.1	.5		.5
	.2	.1			0.12	.2		.1
	.1	.09				.09		.08
	.06							
Abs. press.	629.78	456.11	328.34	235.22	167.94	119.52	85.04	60.40
Pressure ratio	1.38076	1.38914	1.39588	1.40062	1.40512	1.40546	1.40795	

Natural gas sample; specific gravity 0.593; temperature 70° F.; run No. 13 (11-17-45). Sample from tank No. 3 filled at Valve 18 (11-14-45). Sample put in starting 10:41 p.m. ending 10:47 p.m. (11-16-45) at 615 psia. after two cycles of evacuation and filling to 100 psig. Evacuation included supply tube to throttle valve.

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Operating Characteristics of Hypercal

FRACTIONATING COLUMNS

by P. L. Brandt, R. B. Perkins, Jr., and L. K. Halverson

The Heligrid column packing described by Podbielniak[1] and incorporated in the Hypercal columns manufactured by Podbielniak, Inc., is among the best of the high-efficiency column packings developed in recent years, yet there is little information in the literature concerning the performance of the commercially available fractionating columns containing this packing. This paper describes the operation and performance of commercially available Hypercal fractionating columns having a 25-mm. by 36-in. Heligrid packing. The columns used in the experiments were selected at random from a battery of Hypercal columns in use in the laboratory of Pan American Refining Corp. at Texas City, Tex., and all had been used extensively for hydrocarbon distillation prior to use on the experiments. This paper was presented to the Symposium on High-Temperature Analytical Distillation of the Division of Refining, during the annual A.P.I. meeting at Chicago, November 11, 1946. The authors are associated with Pan American Refining Co., Texas City, Tex.

TWO types of Hypercal columns were studied, the only difference being in the reflux control head. One type was equipped with Podbielniak-designed integral reflux control heads and the other with control heads designed by technicians of Shell Oil Co., Inc. The column proper is identical in both types of installation. The columns are insulated with a vacuum jacket, the construction of which is illustrated in Fig. 1. The space within the vacuum jacket contains two metal heat reflecting baffles. These metal baffles very considerably improve the insulating efficiency of the jacket.[1]

Reflux control heads. — The Podbielniak-designed reflux control head is built directly within the vacuum jacket that insulates the column.* The reflux condenser, which consists of a double loop of glass tubing, fits into the top of the column by means of a standard taper joint. The condensate from this condenser falls into a glass cup from the bottom of which a small line leads through a side arm of the jacket to a spherical joint located at the end of the side arm. This line serves as the distillate takeoff line. The interior of the small cup is ground to form a valve seat. A spherical plug which fits into this seat seals the distillate line when reflux is to be returned to the column, the reflux overflowing the cup. The plug is attached to a hollow stem which extends through the space between the condenser tubes and into a vertical cylindrical chamber above the point where the condenser and jacket join. The top portion of this valve stem carries a soft iron bar which fits snugly into the vertical chamber above the condenser-column joint. The vertical chamber is surrounded by a solenoid coil which will lift the valve stem when energized.

In operation, reflux from the condenser falls into the cup, overflows the cup, and is returned to the column when the valve is seated, closing the distillate line, but the entire reflux will be taken overhead when the valve stem is lifted. The reflux ratio can thus be controlled by means of suitable timer switch actuating the solenoid.

*The still head shown in Fig. 1 is similar to the design of the Podbielniak head as described although the jacket of this particular head is not integral with that of the column.

This type of reflux control head has generally performed satisfactorily in this laboratory for several years. The small cup has a holdup of approximately 0.2 ml. and at each lift of the plug this quantity of distillate will be taken over in addition to the proportion of reflux indicated by the timer setting. Under conditions of low vapor throughput this holdup becomes an appreciable part of the total distillate and timer settings must be adjusted to take this holdup into account when setting reflux ratios. Some trouble has been experienced with fouling of the plug seat and plug surfaces with resultant leakage past the plug in closed position. The extent of this difficulty depends upon the nature of the material being distilled and the frequency of column cleaning.

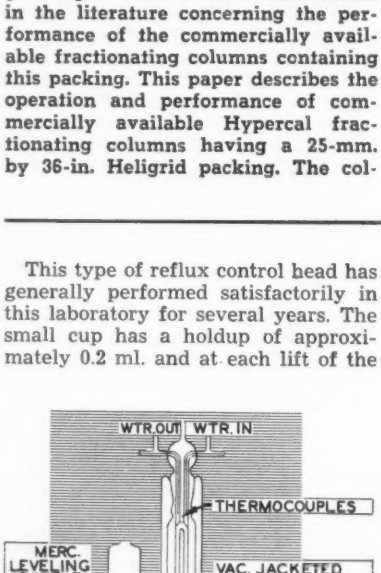


Fig. 1—Construction details of vacuum-jacketed Hypercal column

The Shell-designed liquid-dividing still head which is a tipping-bucket type, has been found to give satisfactory and relatively trouble free performance. Holdup in this still head is probably somewhat greater than the holdup in the Podbielniak still head, but it offers some advantages which tend to compensate. Not the least of these advantages is that the Shell design still head permits the use of thermometers for vapor-temperature measurement.

Still pot and heaters.—The still pots normally used are standard round-bottom flasks equipped with 50/30 semiball joints. Lubrication of the seal between still-pot and column presents somewhat of a problem. Two lubricants which have been found to perform satisfactorily are: (1) a paste of Dow-Corning silicone stopcock grease and graphite (approximately 10 per cent graphite is used in the mixture), (2) the dextrin-mannitol-glycerin stopcock lubricant described by Meloche and Frederick.[2]

The still pots are heated with Glas-Col heating mantles. The voltage to the mantle is controlled by means of a Variac or Varitran.

Boil-up rate control.—Boil-up rate control normally used is manual. The total reflux condensed is calculated from distillate rate and reflux ratio. This method necessitates accurate reflux ratio control. Automatic control mechanisms actuated by column pressure drop have been tried and have been found satisfactory for control of boil-up rate if frequently checked by distillate rate measurement. The vapor-throughput and column-pressure relationship is apparently greatly affected by slight fouling of the packing and thus frequent adjustment of the control is necessary.

Determination of Column Efficiency

Apparatus. — Arrangement of the fractionating column for the efficiency tests is shown in Fig. 1. Boil-up rate was measured as condensate from the reflux condenser, and was calculated from measurement of the heat gained by the water passing through the reflux condenser. Copper-constantan couples were located in the water inlet and outlet lines of the condenser and connected so that the couple in the inlet line served as the cold junction for the pair. Thus the temperature differential was measured directly. The voltage output of the pair of couples was measured with a Brown portable potentiometer equipped with a sensitive galvanometer. The couples were located in the condenser lines at a level below the top of the vacuum jacket in order to eliminate heat loss to the air from the cooling water. They were placed above the condensation ring on the condenser and a small plug of copper turnings was located downstream of the couple in the outlet line to insure complete mixing of the outlet water and uniform temperature throughout the body of the water. The accuracy of water flow and temperature differential measurement were such that the accuracy of heat-gain measurement by this arrangement should be approximately ± 5 per cent. The absolute accuracy of the above procedure for reflux measurement was checked by comparison with direct measurement made by taking the total condensate overhead into a graduated vessel. The accuracy was found to be greater than expected from the accuracy of heat gain measurement. The maximum error found was 2 per cent. Explanation for this is that the distillate measurements were made over a period of 15 minutes or more and during this time several heat-gain measurements were made. The chance errors in heat-gain measurement averaged out during the period in which the reflux was being taken overhead.

Determination of condensation rate by measurement of heat gain in the cooling waters offers some very distinct advantages. Reflux rate can be measured very quickly at any time without disturbing the distillation. The measurements can be made very frequently and the reflux condensation rate can be controlled with accuracy throughout the course of lengthy experiments. In the experiments described below it was necessary to adjust reflux rates rapidly and maintain them constant for several hours. Under such conditions the method of measurement used was found to be very suitable.

Samples of condensate from the top of the column were taken through a mercury-sealed takeoff line. This method of sampling has been described by Oldershaw.[2] It permits thorough flushing of the sampling line and assures that a representative sample of the condensate is obtained.

Samples of the still-pot liquid were taken through a capillary tube extending into the still pot through a side arm on the flask.

Refractive index measurements were made with a Bausch & Lomb precision refractometer which had been carefully calibrated against a test plate. Prism temperature was controlled as closely as possible to 25° C., but actual prism temperatures were determined with a calibrated thermometer and correction of refractive index made where necessary.

All stopcocks in the system were lubricated with dextrin - mannitol-glycerin stopcock grease. In order to determine whether this mixture would cause contamination, the still was charged with pure isooctane which was then refluxed in the still for several hours. Samples of still pot contents and condensate were collected for refractive index measurement. The refractive indices of these samples were identical with that of the charge.

Test mixture. — The test mixture employed was a mixture of n-heptane and methyl-cyclohexane. The n-heptane was a pure grade purchased from Westvaco Chlorine Products Co. This material had a refractive index at 25° C. of 1.38519 for sodium D line, a boiling point of 98.4° C., and a freezing point of —90.6° C. These values agree very well with the values given by the Bureau of Standards.[3] Distillation of this material through a 70-plate column yielded fractions which had the same refractive index as the charge. On the basis of these data it was concluded that the n-heptane was of sufficient purity that it could be used without further purification. The methylcyclohexane used was a heart cut 60 per cent fraction from a pure-grade methylcyclohexane purchased from Dow Chemical Co. The fractionation was conducted in a 70-plate column. The first 20 per cent was distilled at 50:1 reflux ratio and discarded. The middle 60 per cent was distilled at 20:1 reflux ratio. The refractive index of this heart cut was 1.42058 at 25° C. for the D line of sodium.

Analysis of n-heptane and methylcyclohexane mixtures.—The composition of the still pot and condensate samples was determined by refractive index measurement. The equation of Willingham and Rossini[4] for the relationship of composition and refractive index at 25° C. was used.

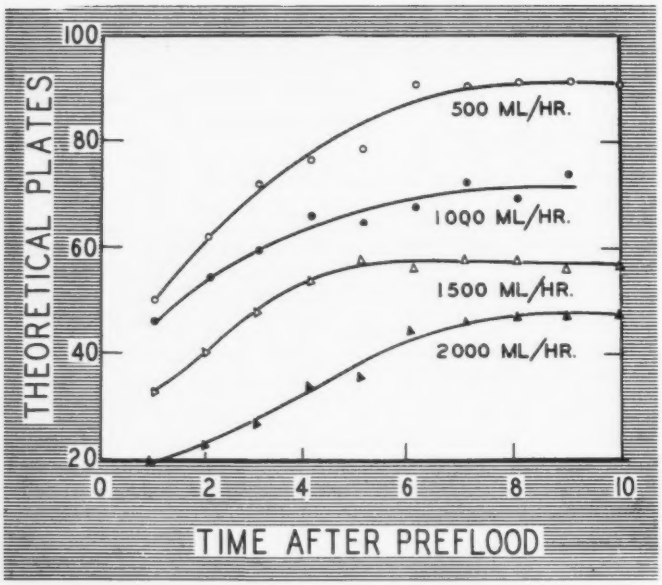
Calculation of theoretical plates.—The theoretical plate efficiencies were calculated by means of the Fenske equation.[5] The value for vapor pressure ratio used in this equation was 1.075.[4] The use of a graph relating theoretical plates and refractive index as proposed by Lecky and Ewell[6] was found to effect a considerable saving in time required for calculations.

Determination of holdup.—Holdup determinations were made in accordance with the procedure proposed by Tongberg, Quiggle, and Fenske.[7] A measured charge of a mixture of isooctane and dibutylphthalate was charged to the column and after being held at total reflux for several hours a sample of the still-pot contents was withdrawn and analyzed for dibutylphthalate by refractive index measurements.

Results of Efficiency and Holdup Tests

A series of experiments was carried out to determine the effect of time at total reflux on column efficiency, and the variation of efficiency with boil-up rate. The general method of operation was to preflood the column, taking care to flood the column along the entire length of the packing, and then as quickly as possible adjust the boil-up rate to the desired value. Samples of the condensate and still-pot contents were taken 1 hour after flooding had ceased and at intervals of 1 hour thereafter until a constant plate value was obtained. The preflooding operation could not be standardized exactly. The exact point at which flood started was apparently determined largely by chance and regardless of the effort to control conditions there was some variation in the location of initial flood. The construction of the column packing in these columns is very complex and some of the columns tended to start the flood in the top sections of the packing and others in the bottom section due very probably to variations in the structure of the packing along its length.

The specific flooding procedure was to adjust the heat so that a section of the column was operating in a flooded state and then vary the heat to cause the flood to move up or down the column so that every part of the packing was flooded at some time in the operation. After the packing had been thoroughly flooded, the voltage was adjusted to a predetermined value which had been found to pro-



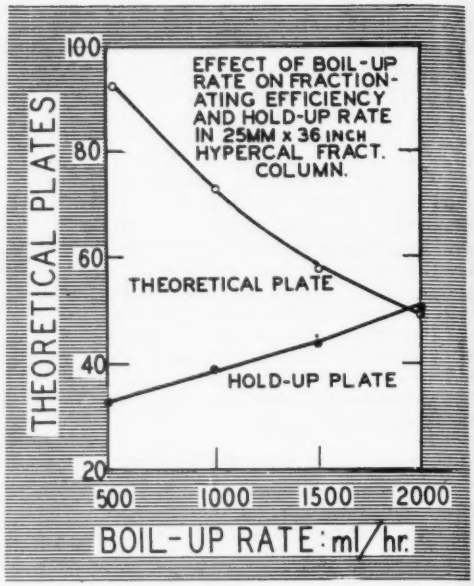


Fig. 2—(Left) Theoretical plates versus times after preflood. These are typical curves for various boil-up rates. The tests are for a 25 mm. by 36 in. Hypercal fractionating column. Fig. 3—(Right) Here, number of theoretical plates (left-side ordinate) and hold-up in ml. (right-side ordinate) are plotted against the boil-up rate. Same column

TABLE 1—VARIATION OF FRACTIONATING EFFICIENCY WITH TIME AFTER PREFLOOD
25 mm. by 36-in. Hypercal Column

Boil-up rate*, ml./hr.	500	1,000	1,500	2,000
Time after preflood, hours	Theoretical plates			
1	50	46	33	20
2	62	54	40	23
3	72	59	48	27
4	77	66	54	34
5	79	65	58	36
6	91	68	57	45
7	91	73	59	47
8	92	70	58	47
9	92	75	57	48
10	92		58	48
11				49
Plates at equilibrium	92	73	58	48

*Measured as condensate from reflux condenser.

TABLE 2—VARIATION OF EFFICIENCY AND HOLD UP WITH BOIL-UP RATE IN 25-MM. BY 36-IN. HYPERCAL COLUMN
(Measured at Equilibrium)

Boil-up rate, ml./hr.	Theoretical plates	H.E.P.T. inches	Hold up ml.	Hold up per plate
500	92	0.39	32.8	0.36
1 000	73	0.49	38.9	0.53
1.500	58	0.62	44.2	0.76
2.000	48	0.75	51.3	1.07

duce the desired boil-up rate. As soon as a steady boil-up rate was established final adjustment of the boil-up rate was made. The time required for preflooding the column was approximately 30 minutes after column reflux had been established and boil-up rate adjustment required about 15 minutes. Time after preflood was taken as time after the flooding in the column had stopped.

The data obtained are presented in Table 1 and Fig. 2. It is immediately apparent that a considerable time at total reflux is required before the column is operating at equilibrium. Approximately 8 hours at reflux is required in most cases. There is very little information available in the literature on the time required for the attainment of equilibrium in packed columns so it is impossible to determine whether this behavior is unique for Heligrid columns or is a common characteristic of all packed columns of comparable fractionating efficiency. The data of Baker, Barkenhaus, and Roswell[9] for spinning band columns show that approximately 3 hours at total reflux is required for the attainment of equilibrium with the 70-plate spinning-band column which they constructed. Since a packed column might be expected to require longer times it is very likely that the behavior of the Heligrid column packing is not unique.

The data of Fig. 2 demonstrate that the time required for reaching equilibrium is not materially affected by boil-up rate. In initial experiments considerable effort was directed toward attempting to develop a preflooding technique which would reduce the time required for equilibrium attainment but all these efforts were unsuccessful. The exact form of the curves shown in Fig. 2 is not reproducible. Duplicate experiments may show a considerable variation in the theoretical plate value after 1 hour reflux although the final equilibrium values may be identical. Despite best efforts to maintain identical operating technique in duplicate experiments this variation could not be eliminated. As an example of the magnitude of the variation encountered a series of determinations at 1,000-ml.-per-hour boil-up rate gave plate values after 1 hour ranging from 10 plates lower to 5 plates higher than the value reported in Table 1 and Fig. 2.

The reproducibility of determination of theoretical plates at equilibrium was found to be ±2 plates. This reproducibility is of the order that might be predicted from consideration of the accuracy of boil-up rate control possible with the equipment used. The value for plates at equilibrium was taken as the average of several determinations. Boil-up rate control is obviously a very important factor affecting the reproducibility of theoretical plate determinations with these columns which exhibit marked change of efficiency with boil-up rate.

Evaluation of a fractionating column requires that column holdup and column efficiency both be determined. It has been amply demonstrated that low holdup is a very desirable column characteristic. The data of Table 2 and Fig. 3 show the relationship of column efficiency at equilibrium and column holdup at various values of boil-up rate. These data demonstrate the advantage of operating the Heligrid packing at relatively low boil-up rates when precise fractionation is required, and further that maximum utilization of the capabilities of the column and reproducible operation require that the boil-up rate be controlled very closely. The 25-m.-diameter Heligrid packing can be operated

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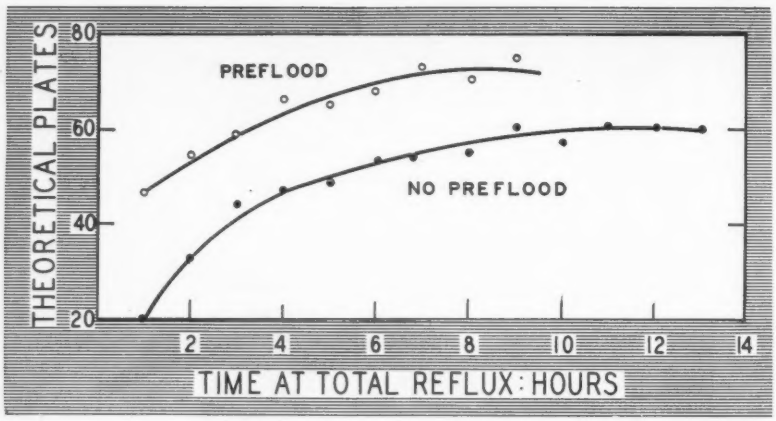

Fig. 4—Effect of preflood on fractionating efficiency. Same size Hypercal column; the boil-up rate is 1,000 ml. per hour

quite satisfactorily at a boil-up rate of 2,000-ml. per hour, but at this rate the maximum fractionating efficiency of the column is only 48 theoretical plates and the holdup is 51.3 ml., or 1.07 ml. per theoretical plate. The same column operating at 500-ml.-per-hour boil-up rate has a maximum efficiency of 92 theoretical plates and a holdup of only 0.36 ml. per theoretical plate. However, even at a higher boil-up rate the fractionating efficiency of the Heligrid column packing is quite good and for many samples the increase in speed of distillation resulting from the higher rates is worth the sacrifice of efficiency. Within the entire range of operating boil-up rates the Heligrid column packing performs quite efficiently and compares very favorably with other high-efficiency packings.

The Heligrid column packing exhibits the phenomenon of improvement of efficiency upon preflooding. The effect of preflood is illustrated by the data of Fig. 4. Rather surprisingly preflooding does not seem to have an appreciable effect upon the time required for the establishment of equilibrium. The slight effect shown may be real although most probably the magnitude of the difference is not more than the reproducibility of the experiments.

Reproducibility and stability of column packing construction is an important factor in the consideration of the performance and characteristics of fractionation column packings. Test data for three columns selected at random from a group of columns are presented in Table 3. Two of the columns were of almost identical efficiency while the third was considerably less efficient. Unfortunately, data are not available on the history of these columns so that no explanation can be given for the low efficiency obtained with column 3. All of the columns tested had been in service almost continually for periods of 2 years or more so that the low efficiency obtained may be attributed to changes which have occurred in use rather than to variation in construction. The fact that two of the columns maintained a high efficiency over a long period of time in use indicates that, in general, the packing is quite stable.

Distillation at Finite Reflux Ratio

The performance of the Hypercal column at finite reflux ratio is illustrated by the data of Fig. 5. A charge of 100 ml. of n-heptane and 300 ml. of methylcyclohexane was distilled at 100:1 reflux ratio after preflooding and 8 hours at total reflux. The distillation was conducted at 1,000-ml.-per-hour boil-up rate. Composition of the distillate as mol fraction n-heptane is plotted against volume distilled in Fig. 5. The utility of these data for column evaluation is limited at the present time since similar data on other fractionating columns are not available for comparison.

TABLE 3—COMPARATIVE EFFICIENCY OF VARIOUS HYPERCAL COLUMNS

25-mm. columns selected at random from group of commercial columns. All 36-in. packed section

Time after preflood, hours	Theoretical plates at 1,000 ml./hr. boil-up rate		
Column No.	1	2	3
1	46	..	37
2	54	40	45
3	59	41	48
4	66	45	49
5	65	50	50
6	68	53	51
7	73	55	52
8	70	59	52
9	75	63	51
10	..	70	52
11	..	70	
Plates at equilibrium ...	73	70	52

Conclusion

A series of tests carried out with Hypercal fractionating columns, each packed with a 25-mm.-diameter by 36-in.-long section of Heligrid packing, have demonstrated that this packing ranks with the best of the small-column packings. The equivalent of 90 theoretical plates and a hold-up of 0.36 ml. per theoretical plate are obtainable at boil-up rates of 500 ml. per hour. The fractionating efficiency falls off with increasing boil-up rate. At 2,000 ml. per hour the theoretical plate value is 48 and the hold up 1.07 ml. per plate.

(Continued on page 102)

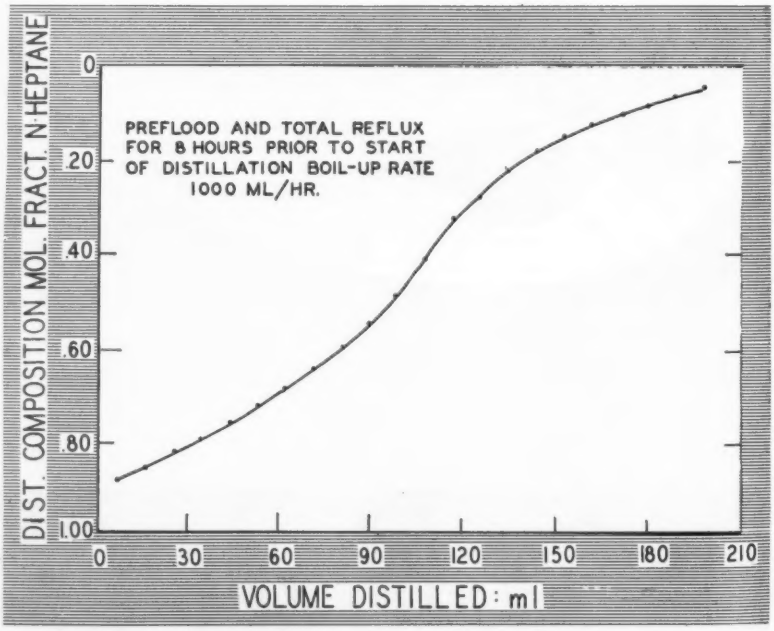

Fig. 5—Distillation curve of a mixture of n-heptane (100 ml.) and methyl cyclohexane (300 ml.). Boil-up rate was 1,000 ml. per hour. Prior to start of distillation, column preflooded and total reflux run for 8 hours

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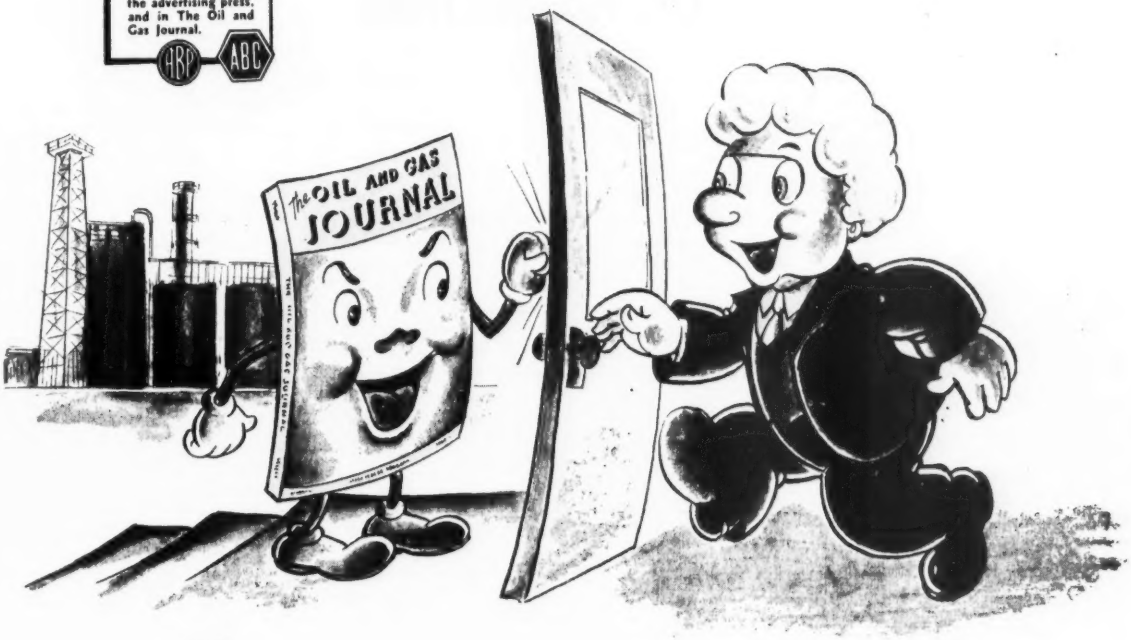

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Interference Between Wells

by Park J. Jones*

OIL PRODUCTION by water

PART 6 OF A SERIES

OIL production is by virtue of the drawdown between reservoir and bottom-hole operating pressures. The available drawdown for one well is 100 per cent. But the available drawdown for two additional wells may be less than 90 per cent even if they are located as much as 1,000 ft. on two sides of, and on strike with, the first well. This is interference between wells. Let n wells be located on a parallel to a water contact. Denote the available drawdown for the row by 100 per cent. The available drawdown for another row of wells located updip from, and parallel to, the first row is only 37 per cent provided the wells on the second row have the same bottom-hole operating pressure as the wells on the first row and oil production is by edge water. The interference between two rows of wells is greater than between wells on one row.

Location of Wells

LOCATION of wells within the structurally highest contour is necessary if reservoirs have no primary gas cap and oil production is by water. But the number of wells required by a reservoir is usually greater than the number which can be located with the said contour. Several rows of wells are required as a rule. But interference between wells exists[1,2] even if only one row of wells were drilled.

The structurally lowest row of wells is here called the first row. Other rows are numbered consecutively in the updip direction. The first row is closer to water than any other row. Fig. 6-1 is a plan view of Row 1. The distance from water to Row 1 is denoted by d. When the distance from water to the individual wells on Row 1 varies, the value of d is the average distance for all the wells on the row.

Rows 2, 3, and so forth are on the updip side of Row 1. The number of wells on Rows 2, 3, and so forth may decrease in the updip direction. The last row on radial reservoirs may have only one well.

*Production consultant, Houston.

Well-Completion Efficiency

The productivity of a well varies with the effective permeability of a reservoir-well system. The effective permeability of a reservoir-well system relative to a fixed position of an oil-water interface is derived from two components. One component, K_r, is the effective permeability in a reservoir. The other component, K_w, is the effective permeability of a well. The latter depends on completion efficiency. Mud filtrate, cement, and casing may reduce K_w down to a small per cent of the reservoir permeability K_r.

The approximate effective permeability K of a reservoir-well system may be obtained as follows: Assume that well-completion methods influence permeability out to, say, 2 ft. from the axis of a well bore. Let P_d be the pressure at d feet from a well; P_2, the pressure at 2 ft. from the axis of a well; and P_b, the bottom-hole operating pressure. The pressure drawdown ΔP is equal to the sum of the pressure drops in the reservoir and into the well, that is:

$$\Delta P = P_d - P_b = (P_d - P_2) + (P_2 - P_b) \quad (1)$$

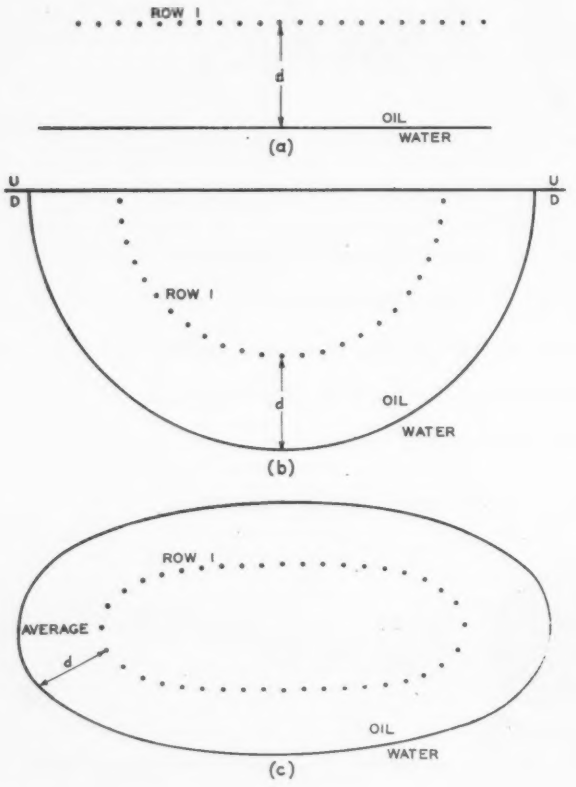
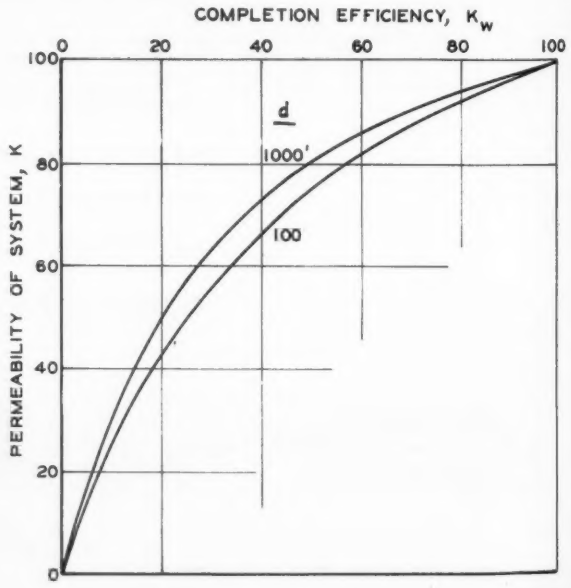


Fig. 6-1—(Left) Illustrating linear, radial, and elongated rows of wells. Fig. 6-2—(Below) Permeability of a reservoir-well system in per cent of reservoir permeability vs. completion efficiency K_w in per cent of reservoir permeability; d is radial distance from a well; K_w is the average permeability within two feet of a 6-in. well bore



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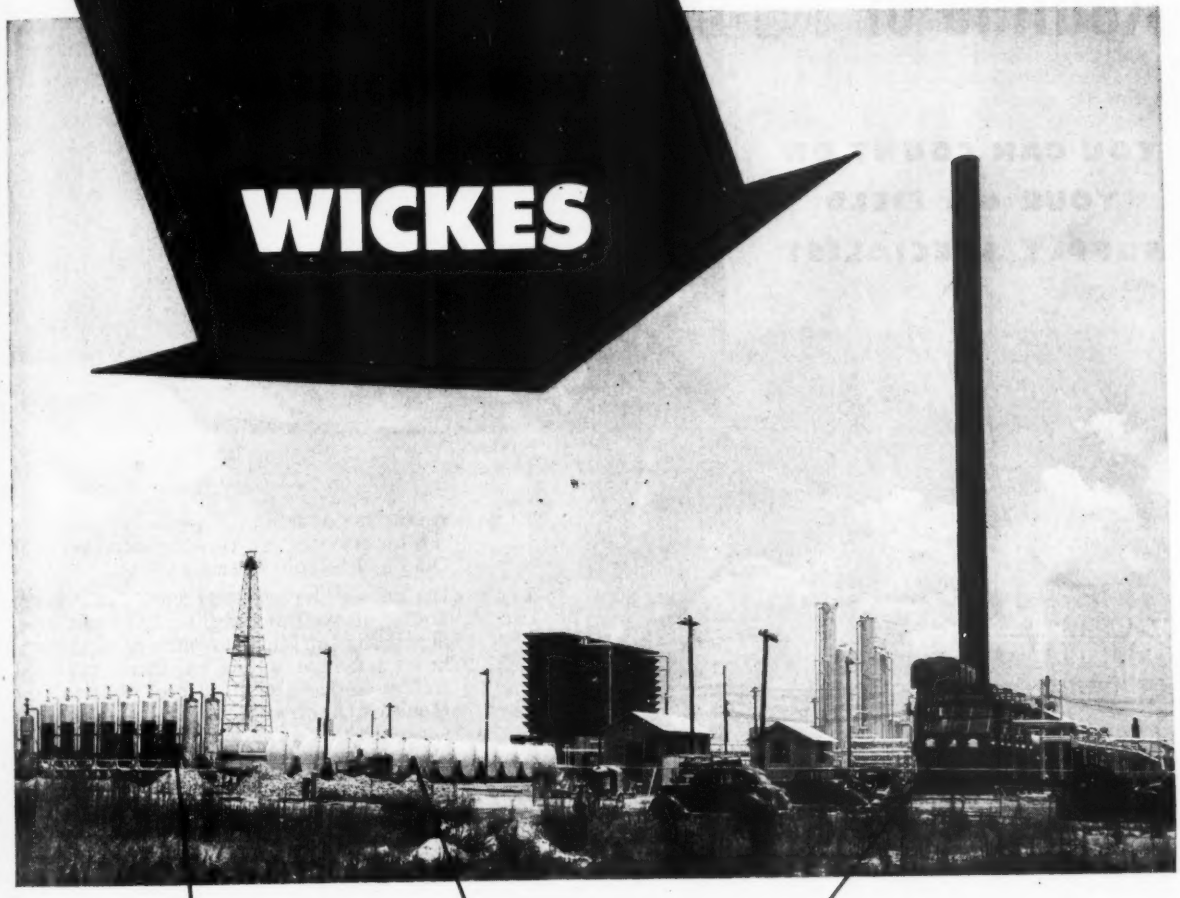

A number of the complete metal fabrication facilities of The Wickes Boiler Co. are represented in this picture of a Midwest oil refinery. Wickes built the refractory towers shown at the extreme left and center right of picture. Wickes built the storage tanks aligned by the derrick. Wickes built the towering stack. Wickes built the three Type "A" Water Tube Boilers shown at the foot of the stack.

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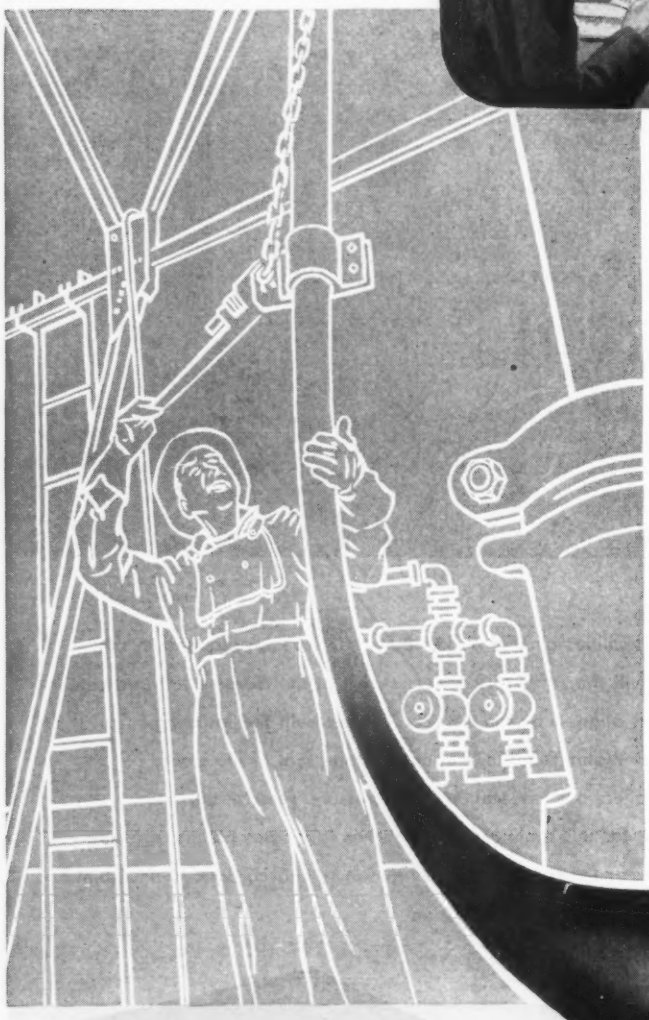

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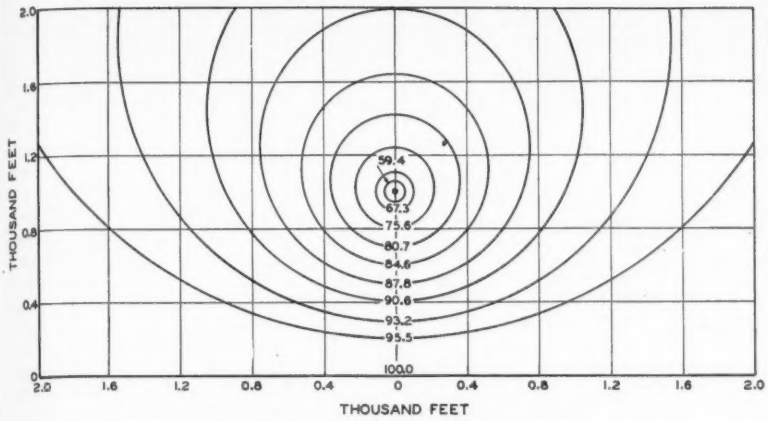


Fig. 6-3—Pressure contours in per cent of the drawdown by one well located 1,000 ft. from water. (Data by Muskat)

But pressure drawdown varies directly with the logarithm of distances and inversely with effective permeability. So it follows that:

$$\frac{\log d/r}{K} = \frac{\log d/2}{K_r} + \frac{\log 2/r}{K_w} \quad (2)$$

from which

$$K = \frac{K_r K_w \log d/r}{K_w \log d/2 + K_r \log 2/r} \quad (3)$$

The curves in Fig. 6-2 are solutions of Equation 3. The permeability of a reservoir - well system is plotted against completion efficiency. The latter is expressed in per cent of reservoir permeability. The completion efficiency of most perforated wells probably does not exceed 50 per cent. The corresponding effective permeability for a reservoir-well system is about 80 per cent of the reservoir effective permeability. About 20 per cent of the pressure drawdown in perforated wells is not likely to extend beyond the immediate vicinity of such wells. When wells are considered, the permeability of reservoir-well systems should be used.

Pressure for One Well

Consider a well located d feet updip from an oil-water interface. Let the oil-water interface be the X axis. Draw a line through the well and at right angles to the interface. Call this line the Y axis. The location of the well is (O, d). The distance d from water to the well is small compared to the length of the interface.

Let P_d be the pressure at the interface and ΔP the drawdown. Muskat has shown[1] that the presspre P at any point such as (X, Y) is given by:

$$P = P_d - \frac{\Delta P}{2 \log 2d/r} \log \frac{X^2 + (Y + d)^2}{X^2 + (Y - d)^2} \quad (4)$$

where r is the radius of the well bore in feet.

The contours in Fig. 6-3 show the distribution of pressure about one well located 1,000 ft. from edge water. It will be noted that the available drawdown even at 1,000 ft. on either side of the well is about 90 per cent. This causes interference between wells.

Producing Capacity of One Well

Suppose all wells are shut in except one. Let the location of this well be on a No. 1 row. The producing capacity for one well on a linear row is defined[1] by:

$$Q_w = \frac{3.07\, h\, K\, \Delta P}{\mu b \log 2d/r} \quad (5)$$

where

- b = volume factor for oil, barrels of space per barrel of oil
- d = distance to water, feet
- h = average pay thickness through which oil is displaced, feet
- K = effective permeability of reservoir-well system, darcys
- ΔP = pressure drawdown between water and well, psi.
- Q_w = producing rate into one well, barrels of oil per day
- r = radius of well, feet
- μ = viscosity of reservoir liquid, centipoises
- log = common logarithm

The curves in Fig. 6-4 are solutions of Equation 6. The oil-producing capacity of a well having a 6-in. diameter is plotted against the average distance to water. The factors

$$\frac{h\, K\, \Delta P}{\log 2d/r}$$

Fig. 6-4—Oil-producing capacity of one well on a row averaging d feet from water: no interference between wells. (After Muskat)

should have average values based on all wells on Row 1. Evidently, the influence of distance from water on the producing capacity of wells is nominal by comparison with completion in pay h, permeability K, or pressure drawdown ΔP.

Productivity for One Row Systems

Consider a row of wells averaging d feet from, and parallel to, an oil-water interface. The average per-well producing rate in barrels of oil per day is defined[1] by:

$$Q = \frac{3.07\, h\, K\, \Delta P}{\mu b \log y} \quad (6)$$

where

$$y = \frac{ae^x}{6.28r} \quad (7)$$

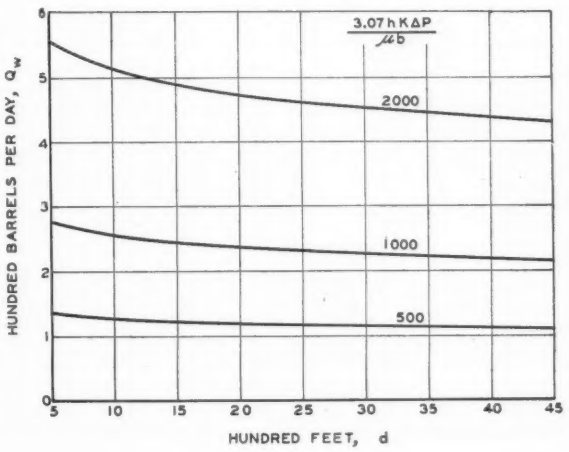
and

$$x = \frac{6.28d}{a} \quad (8)$$

The per-well producing capacity defined by Equation 6 is for uniform conditions as to reservoir and well thickness and permeability. The symbol "a" denotes the distance between wells in a row, e is the constant 2.718. The other symbols have the same meaning as in Equation 5. The bottom-hole operating pressure is the same for all the wells on the row.

The distribution of pressure difference for one ideal linear row of wells is shown in Fig. 6-5. The section is along dip through a well. Pressure is in per cent of the total drawdown. The distance to water equals the distance between wells in the row, d/a = 1. The pressure updip from the row is only about 37 per cent of the drawdown. Accordingly, the total updip pressure is equal to the bottom-hole operating pressure plus 0.37 times the drawdown. The available updip drawdown is only 37 per cent.

The per-well producing capacity of the wells in a row varies with the distance between wells. The following data by Muskat for d/a = 1 indicate the magnitude of interference between wells:



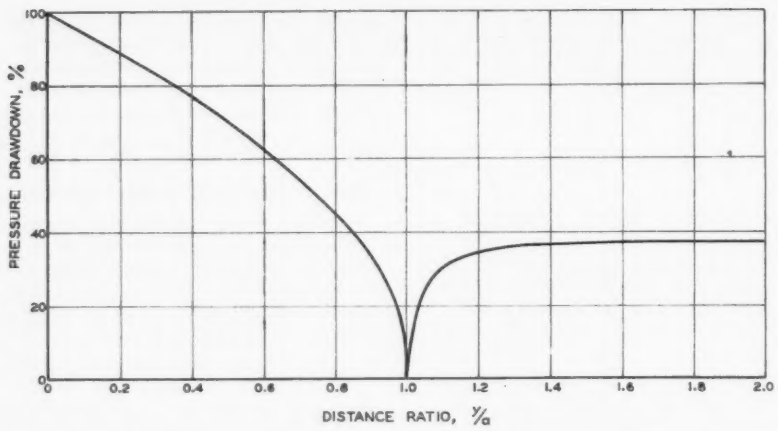


Fig. 6-5—Pressure drawdown along dip in per cent of drawdown by a row of wells located at a distance d from water equal to the distance (a) between wells in the row; the section is through a well. (Data by Muskat)

Number of wells in row	1	2	3	n
Interference factor, %	100	89	84	64

The 64 per cent relative per-well producing capacity is for 100 ft. between wells in a row. Interference between wells about 100 ft. apart in a row is roughly 36 per cent.

Practical spacing requires distances between wells which are not less than 200 ft. even for reservoirs at post-hole depths. Accordingly, the average per-well producing capacity for n wells on a row is not likely to be less than 64 per cent of that for an average well on a No. 1 row. The number of wells n on a No. 1 row varies in accordance with Equation 6. It is tentatively assumed that the interference factor decreases from 100 per cent for one average well down to 64 per cent for five or more wells on a No. 1 row.

Let Q_1 equal the producing capacity of Row 1. Upon multiplying the right side of Equation 5 by 0.64n, we obtain:

$$Q_1 = \frac{1.96n\ h\ K\ \Delta P}{\mu b \log 2d/r} \qquad (9)$$

Evidently,

$$\frac{Q_1}{n} = 0.64\ Q_w$$

Consequently, the value of $\frac{h\ K\ \Delta P}{\log 2d/r}$ in Equation 5 should be the average value for n wells on a row. For instance, if the completion in pay for the w_i well is h_i feet, the average value of h in Equations 5 and 9 is given by:

$$h = \frac{\sum_1^n w_i h_i}{n}$$

Similar considerations should be applied to permeability K and the average distance to water. The producing capacity of n wells, all on one row, is approximately 0.64n times a graph value in Fig. 6-4 provided the quantity $\frac{h\ K\ \Delta P}{\log 2d/r}$ used for one well is an average value for the n wells.

Producing Capacity for Two Rows

Consider two rows of wells located parallel to each other and to water. Let the bottom-hole operating pressure be the same for both rows. Denote the per-well average producing capacity for the wells in Row 1 by Q_1 and for the wells in the second row by Q_2. Because the available drawdown in Fig. 6-5 is only 37 per cent, the ratio of per-row producing capacities Q_1/Q_2 is about two. The wells in the first row can produce about twice as fast as those in the second row. The first row of wells gets about two-thirds of the total production, $Q_1/(Q_1 + Q_2) = \frac{2}{3}$, at uniform bottom-hole operating pressure and number of wells per row.

The productivity of a two-row system is[1] about 1.2 times the productivity of a one-row system. Consequently, the per-well average producing capacity for two rows is about 60 per cent of that for one row. These data are for equal distances between wells in a row, between rows, and from water to the first row. However, deviations from the two-thirds rule for a first row relative producing capacity are nominal within the limits of practical distances between rows and between wells on a row.[1]

The average per-well producing capacity for n wells on each row of a two-row system is about 60 per cent of the average per-well capacity for n wells on a one-row system provided other things are equal and all wells have the same bottom-hole operating pressure.

Let n equal the number of wells on Row 1. Upon multiplying the right side of Equation 9 by 1.2, we obtain Q_2 the total capacity for two rows:

$$Q_2 = \frac{2.35n\ h\ K\ \Delta P}{\mu b \log 2d/r} \qquad (10)$$

Let N equal the total number of wells for two rows. The average per-well capacity is on the order 1.2n/N where $N \geqq 2n$. The relative per-well capacity for one average well on Row 1 is taken at 100 per cent. The per-well average capacity for n wells on Row 1 is 64 per cent. The average per-well capacity for 2n wells on two rows is 64 (1.2)/2 or 38.4 per cent. It is assumed tentatively that the interference factor for a two-row system is 38.4 per cent. The ratio of the wells on Row 2 to that on Row 1 of a two-row linear system is on order of unity.

Producing Capacity for Several Rows

The per-row producing capacities for three rows operated at equal bottom-hole pressures are[1] in the ratio 5:2:1. The first row gets about five-eighths of the total production. Rows 2 and 3 combined get about three-eighths of the total production. The second row produces twice as fast as the third row.

Other things equal, the productivity of a three-row system is only slightly higher than that of a two-row system. It may be about 1.23 times that of a one-row system. Accordingly, the average per-well producing capacity by water encroachment at a given time is on the order 41 per cent of a one-row system.

Migration across the first row increases from about 33 per cent for a two-row system up to about 37 per cent for a three-row system. As migration across the first row increases only 4 per cent when a third row is added, the increase of migration across the first row is likely to be negligibly small in four, five or six-row systems. Other things equal, the per-well productivities, number of wells and total producing rates are likely to be as follows:

Number of rows	1	2	3	r>3
Per-well productivity, per cent	100	60	41	123/r
Relative number of wells	1	2	3	r
Relative total producing rate	1.00	1.20	1.23	1.23

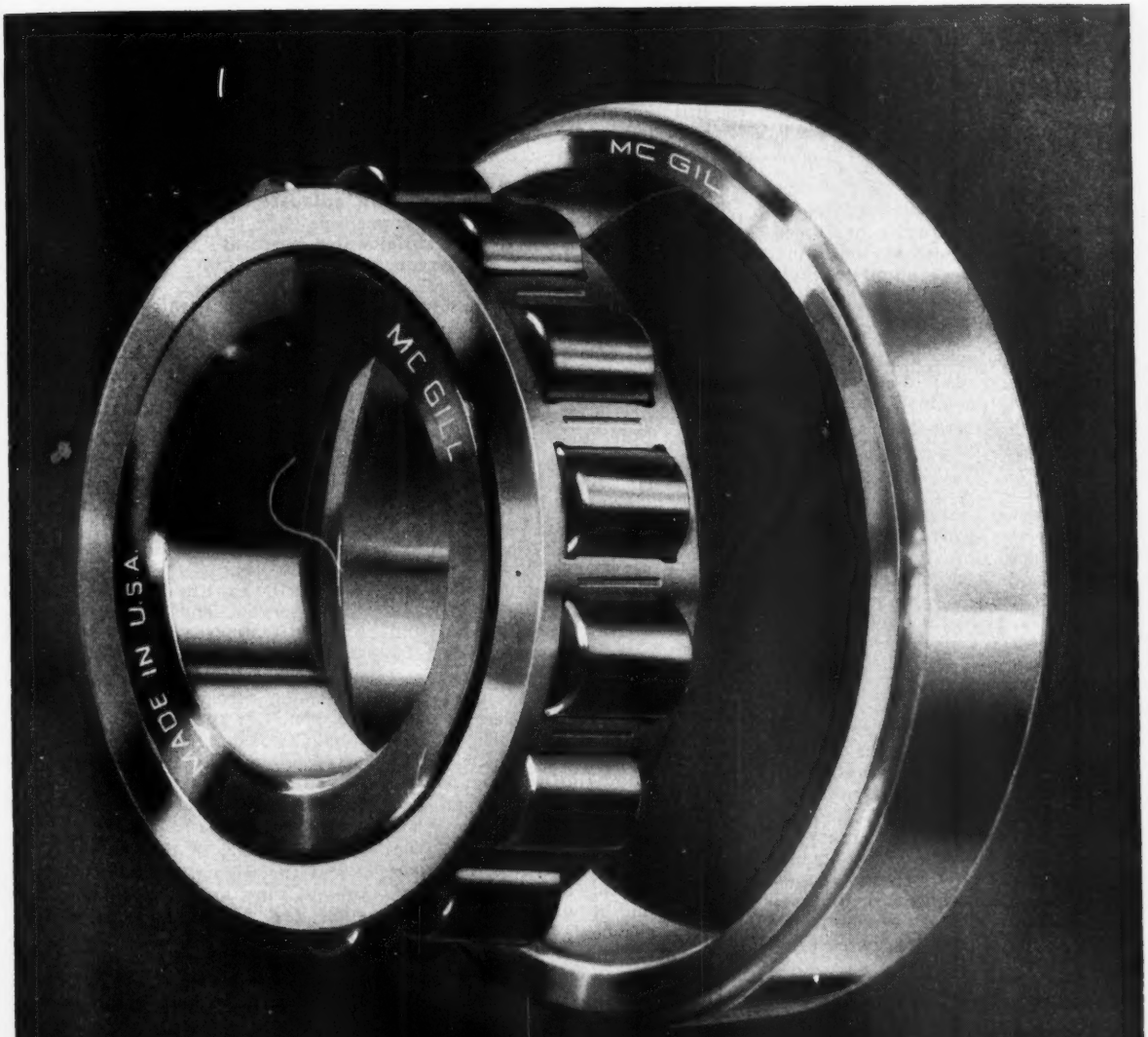
Let n equal the number of wells on Row 1. Upon multiplying the right side of Equation 9 by 1.23, we have Q_r, the total producing capacity for three, or more rows of n wells on each:

$$Q_r = \frac{2.4n\ h\ K\ \Delta P}{\mu b \log 2d/r} \qquad (11)$$

In the case of linear reservoirs, 3n wells usually can be located on three rows. But radial and elongated reservoirs require more than three rows for regular or staggered spacing.

References

1. Muskat, M., "Flow of Homogeneous Fluids," McGraw-Hill Book Co., New York.
2. Barnes, K. B., "Well Interference," The Oil and Gas Journal, April 13 and 20, May 4 and 18, 1946.



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Unitization and Pressure Maintenance May Treble Oil Recovery

(Continued from page 81)

ilar operations where much additional recovery of oil already has been achieved or is indicated for the future as a result of unit operation, reservoir control, and injection work are the Schuler pool in Arkansas; the Erath, Haynesville, and Cotton Valley pools in Louisiana; Salt Creek, Lance Creek, and Elk Basin pools of Wyoming, and in the Paloma pool in California.

The West Cement Medrano sand reservoir very likely offers the best related group of factors—structure, sand character, reservoir fluid arrangements, etc.—of any oil field in Oklahoma, as regards increasing recovery by unit operation and gas injection. There is a large and widespread gas cap. The structure is of the wedge or flank type, and has an extremely sharp dip to the south. For every 100 ft. of horizontal distance the average vertical dip is 37 ft. The producing sand is quite clean and not appreciably broken by impermeable streaks or shaly zones, and it has comparatively uniform permeability and porosity. The pool has by far the greatest closure of any in Oklahoma. There is a maximum vertical interval of 1,817 ft. from the highest point in the gas zone to the lowest point in the oil zone. In general, in the oil zone itself, the vertical distance from the top of the oil zone to the base is 741 ft.

Large Free-Gas Cap

Unlike most Oklahoma oil pools, the West Cement reservoir has a very large free-gas cap in relation to the oil zone. The proportion, on a pore-volume basis, of gas zone to oil zone is 1.04 to 1. Originally the gas zone contained 100 billion cubic feet of gas and the oil zone 97 million barrels of oil. The areal extent of the gas cap occupies 1,980 acres, the oil zone 1,300 acres.

Full use of the expansive energy in this large gas-cap zone, as an upper plunger to squeeze on the underlying oil section for the purpose of producing more oil, can only be accomplished by operating practices made possible by the unit plan. Producing plans under the unit program call for closing in the gas wells and producing only the low-gas-oil-ratio oil wells located at intermediate positions in the oil zone between the gas and water levels. In addition, gas which is produced along with the oil and which now of necessity is being vented, under the proposed program will be returned to the gas zone. Furthermore, because of the uniform nature of the field and the steep dip of productive formation, the reservoir conditions appear quite favorable to the injection of water into the water zone which lies downdip on the south side of the field. The gradual rise of the water zone by such injection thus can serve as a second plunger or piston, this time on the other side of the oil section and thus giving further squeeze of the oil from the other direction. No natural water drive has been indicated so far from the production performance and reservoir history, so the injection of water into water zone should result in an efficient mechanism to displace oil upward and obtain substantial gains in future oil recovery.

RESERVOIR AND PRODUCTION DATA—WEST CEMENT MEDRANO POOL

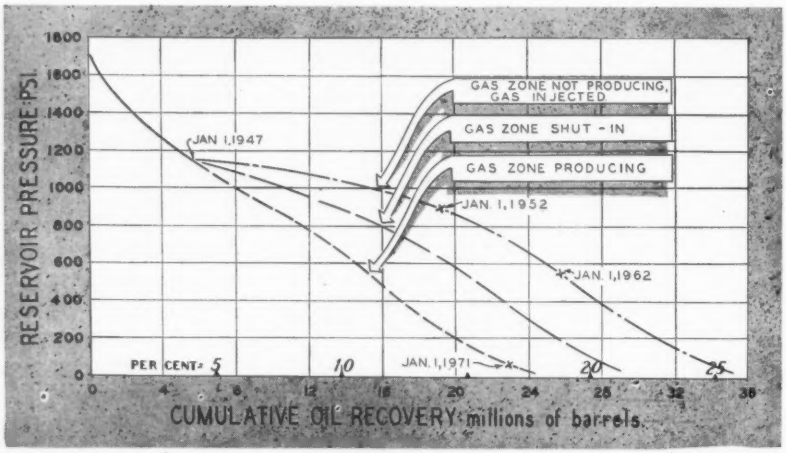
Formation data:	
Sand thickness, ft.:	
Gas zone	**66**
Oil zone	**95**
Permeability, millidarcys	**300**
Porosity, per cent	**16.5**
Interstitial water, per cent	**20**
Reservoir temperature, °F.	**116**
Reservoir crude data:	
Saturation pressure, psi. (—4,370 ft.*)	**2,130**
Solution gas at 2,130 psi., cu. ft. per bbl.	**427**
Formation volume factor at 2,130 psi.	**1.165**
Viscosity at 2,130 psi. and 116° F. centipoises	**1.8**
Present oil production, bbl. per day	**5,200**
Present reservoir pressure, psi.*	**1,280**
Crude oil, A.P.I. gravity at 60°/60°	**37**

***Midpoint of oil section.**

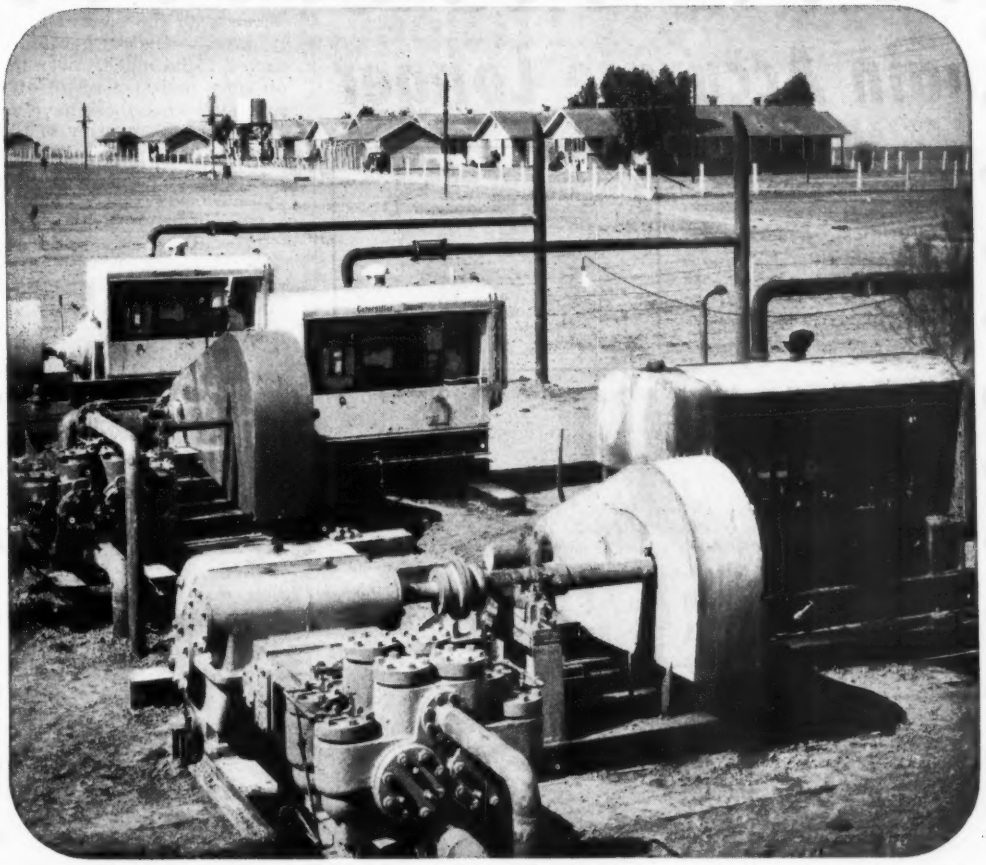
While there are many other productive sands in the West Cement field, the Medrano sand has proved to be much the most important reserve and the unit program covers only that one sand. The Medrano sand was first penetrated in the gas zone in October 1936 by a well high on structure. Other gas wells drilled soon afterwards in this area also produced only gas, and it was then felt that merely a gas pool was present. Development of this so-called gas pool continued for 6 more years, during which time 30 billion cubic feet of gas were produced.

In March 1943, the first oil well penetrated the oil zone at a point lower on the flank of the structure. Additional oil wells subsequently were drilled in the lower portions of the reservoir, and pressure surveys and correlations established the fact that a rather extensive oil zone existed which was a contiguous part of the same reservoir, underlying the gas zone. At the time first oil production was obtained the average reservoir pressure had declined to 1,700 psi. in contrast to the original reservoir pressure of 2,000 psi. (datum at gas-oil contact).

Coincident with the oil withdrawals of the 6.5 million barrels to the present time, an additional 37 billion cubic feet of gas have been withdrawn from the gas zone, making a total of 67 billion cubic feet of gas produced. In terms of reservoir pore space the oil withdrawals have been only 6.7 per cent of the total stock tank oil originally in place, while the withdrawals of gas from the gas zone have amounted to 60 per cent of the gas originally in place. From a reser-



This chart displays the computed reservoir pressure—oil recovery relationships for three of several possible modes of operation of the West Cement pool. Details of these computations are discussed on pages 100 and 102



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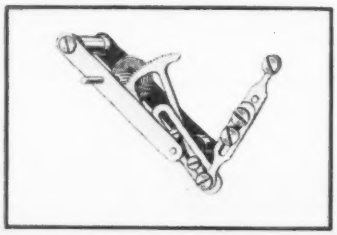
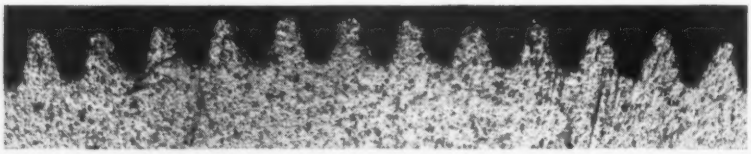
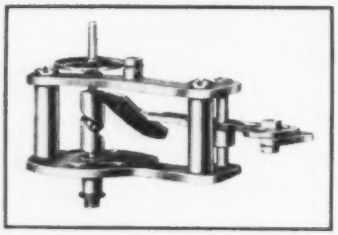


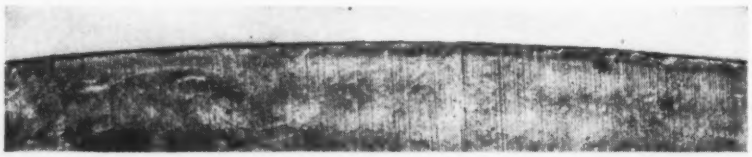
The movement of the ordinary pressure gage operates by means of a toothed segment and a spur gear as shown at right.



Magnified 12 times, the teeth of this new, unused sector are jagged – anything but uniform. Pinion teeth are cut the same way. Friction, wear and consequent inaccuracies are caused by these rough surfaces rubbing together.



Helicoid Gage movement has a polished, graphited Bakelite cam and a polished helicoid roller – instead of sector and pinion.



Cam of Helicoid movement magnified 12 times, shows smooth, polished surface. Helicoid roller surface is also highly polished. Longer wear and smoother operation result from these two polished surfaces in rolling, point contact.

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voir-voidage standpoint, it is thus apparent that in the past the gas zone has been much more heavily produced than the oil zone. Consequently, pressure in the gas zone has continued to be much lower than in the oil zone, and as a result of this pressure difference there have been losses of oil through wetting of the dry gas sand, as previously mentioned.

In conducting studies of the West Cement Medrano reservoir which have culminated in the present plans for the future operation, a committee of eight geologists from the different operating companies has mapped the sand body on practically every conceivable basis. This resulted in the reservoir factors being accurately determined throughout as to structure, thickness, pore volumes, and contents.

The engineering work likewise was carried on in committee form by engineers from several of the companies, with all pertinent factors considered and a number of programs analyzed before the selection of the present plan as the one which would lead to maximum recovery of oil and gas. In their work, the engineers made computations of future reservoir pressures, gas-oil ratios, and oil recovery through the use of the procedures recently outlined[1] (condensed pictorial results of such method are given in The Oil and Gas Journal issue of December 8, 1945, page 77). In brief, it appears that the future recovery or reserves possible under the present producing practices are 14 million barrels of oil. By merely closing in the gas production from the gas zone, as will be possible by unitization, an additional 3 million barrels of oil may be saved for future production by preventing further wetting of the gas cap by oil "fingering" up structure; the energy conserved by closing in the gas cap will account for an additional 5 million barrels; the injection of produced gas into the gas cap zone may account for 5.5 million more barrels if 60 per cent of the gas is returned. If 80 per cent, or more, of the produced gas is rejected, additional recoveries of 4.5 million more barrels may be in sight.

Gravity segregation of the oil will be much more complete under the type of production control contemplated, particularly at the higher pressures which will prevail, and it is felt that this feature may account for additional recoveries. Then, finally, if later experimental work with flank-water injection works out favorably, and the conditions as now indicated for such work are excellent, there is a potential additional recovery by that procedure of up to 20 or more million barrels. All told, these possibilities total up to that of eventually recovering 52 million barrels of oil from the reservoir in the future. This is in the neighborhood of 300 per cent more future oil than indicated

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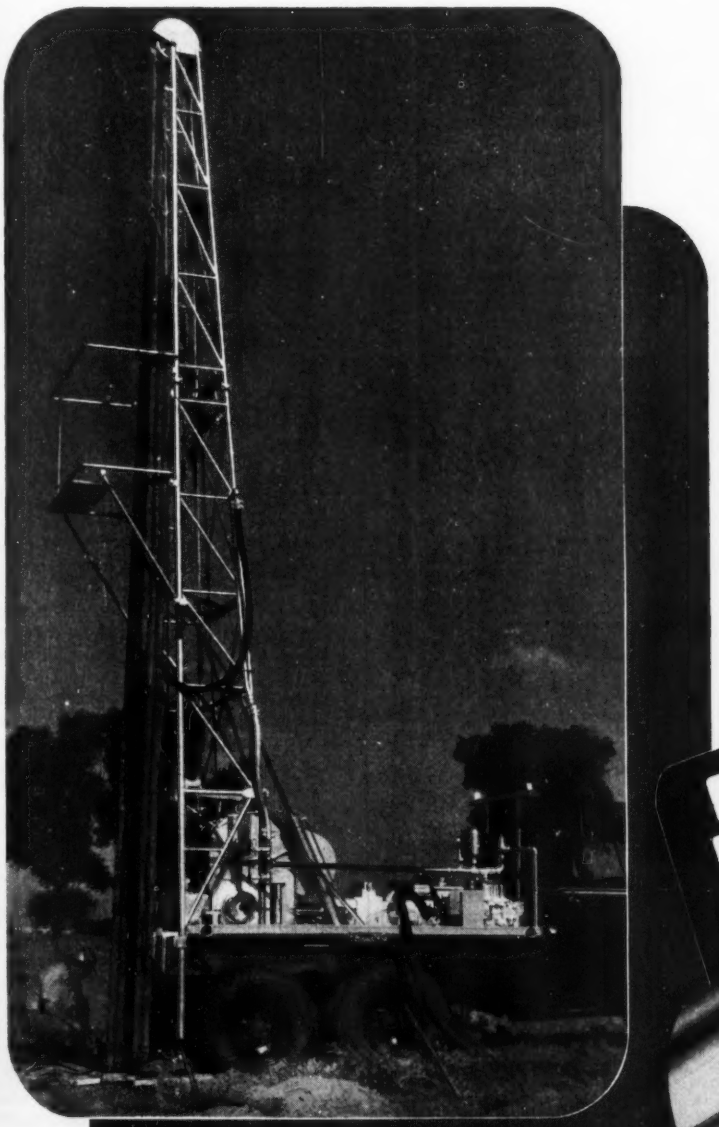

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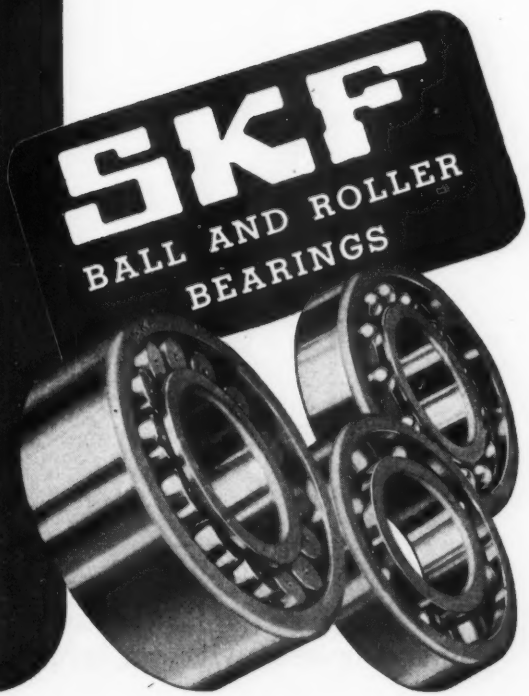

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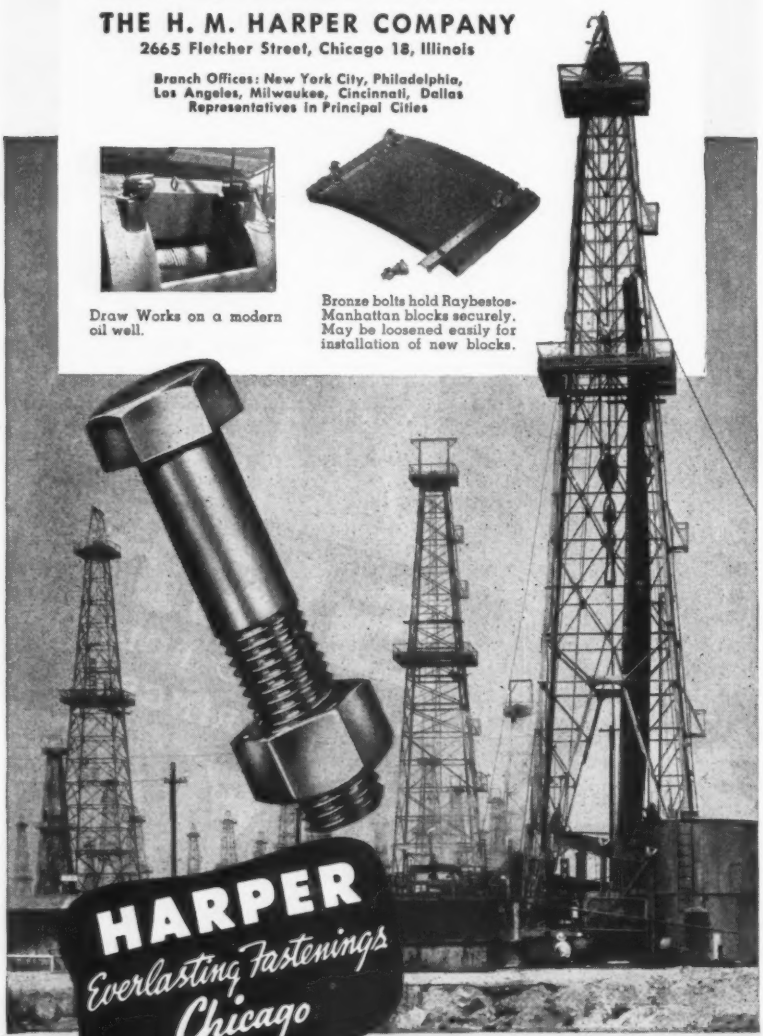

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First thing to be done when the unit plan is approved will be to close in all of the gas wells and all of the high-gas-oil-ratio oil wells. This one step will immediately reduce the reservoir withdrawals by a ratio of six to one, which is a 500 per cent decrease.

Next step will be the drilling of a number of additional oil wells at strategic positions in the oil zone so that best advantage can be taken of structural conditions and gravity segregation of the oil uniformly down through the oil zone to the recovery wells.

Third step will be the start of the gas-injection program. A number of injection wells will be selected from the present gas wells. New construction will include a compressor plant, a dehydrator unit, and the necessary gas-gathering and injection systems. All told, the capital expenditure involved in the plan, not including those which may be necessitated by flank water injection operations, will total approximately 2 million dollars

Reference

1. M. Muskat, "The Production Histories of Oil-Producing Gas-Drive Reservoirs," Journal of Applied Physics, Vol. 16, No. 3 March 1945.

Hypercal Columns

(Continued from page 90)

Considerable time at total reflux is required for attainment of equilibrium. On the average, 8 hours is required to reach a maximum value. Exact significance of the time required to reach equilibrium in relation to the performance of the column at finite reflux ratio has not been determined, but this characteristic of the packing indicates that further work should be carried out to establish the point. Distillation data at 100:1 reflux ratio of a mixture of n-heptane and methylcyclohexane are presented to serve as a basis of comparison with the operation of other columns for which such information may be available.

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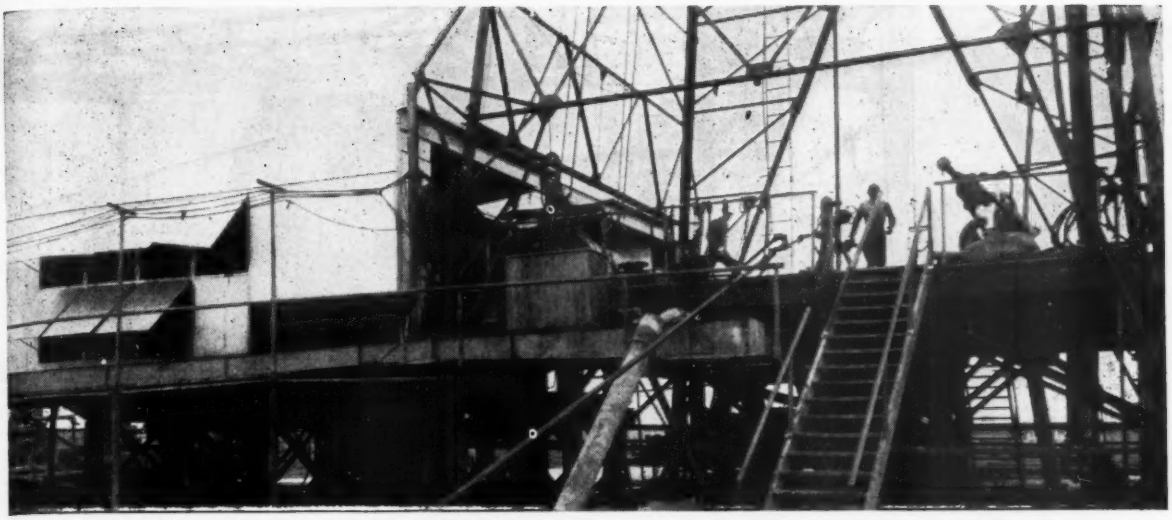


In this typical application of sodium chromate to drilling mud, the rectangular chemical mixing tank installed over the mud line from the well head is used both in initial inhibitor addition and subsequent mixing to maintain proper strength. The rig is drilling in southwest Andrews County, West Texas

Sodium Chromate Used in Permian Basin Drilling to Combat Salt-Water Corrosion

by George Weber

IN the current campaign to reduce drill-pipe failures due to corrosion fatigue in the Permian basin, drilling contractors and operators are continuing to experiment with inhibitors in laboratory and field. One of the more important chemicals now employed to combat salt-water corrosion is sodium chromate. Research study continues in an effort to determine the exact effect and efficiency of this inhibitor in drilling the salt sections of West Texas and New Mexico. Pending direct recommendations based on the completed study of the chemical, a generally accepted practice has evolved among those who have consistently used sodium chromate on a limited number of rigs for over a year. Supply of the chemical is limited, with no immediate increase in prospect, so its widespread use is not expected for about a year.

Sodium dichromate or sodium bichromate as it is often called, may also be used in the field since it is easily reduced to sodium chromate by mixing with caustic in the proportion of 25 lb. of caustic to 100 lb. of sodium dichromate. The reduction reaction which converts the orange dichromate into its deep yellow derivative is: $2\ NaOH + 1\ Na_2Cr_2O_7 = 2\ Na_2CrO_4 + H_2O$. This reaction can be carried out by manually mixing dichromate and caustic with water in a drum or chemical barrel.

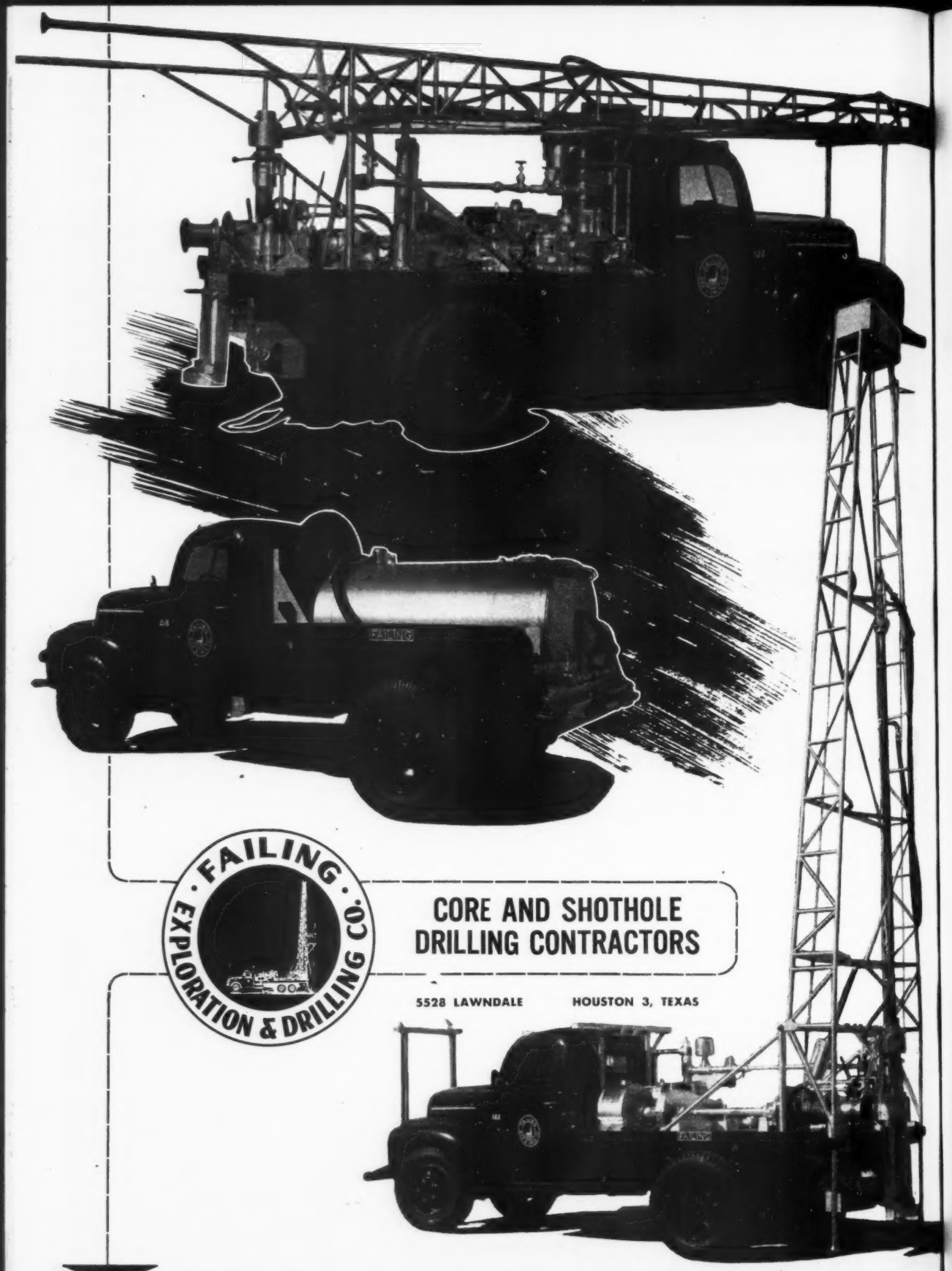
Proportion in Drilling Mud

Although laboratory immersion tests show that a sodium chromate concentration of 1,000 p.p.m. reduces corrosion of steel samples in salt-water muds by 94 per cent in practice the proportion used in drilling muds ranges from 1,800 to 3,000 p.p.m. and averages 2,000 p.p.m. Most drillers mix 50-100 lb. of chemical to about 50 gal. of water in a common oil drum or chemical mix tank. It is added slowly, in the amount calculated to give the desired proportion, at the rate of about 50 gal. per hour into the flow line, either before or after the shale shaker. The proper concentration can easily be checked by colorimetric titration using dropper bottles, recording the results either directly in parts per million or pounds per barrel. Once the mud has been brought to the desired concentration of sodium chromate, small daily additions will serve to maintain proper proportions. The principal mud service company in the Permian basin performs this service for many of the rigs using the inhibitor.

At the average strength of 2,000 p.p.m., sodium chromate costs 6 cents per foot drilled on most Permian basin wells. It is possible but not probable that cost of the chemical in the field may be reduced. Suppliers are able to obtain sodium chromate and sodium dichromate only in limited quantities but expect to deliver to rigs at lower prices if and when bulk shipments are available.

That prospect is not bright for many months due to acute shortages of both chromium and the alkalies required for the inhibitor's manufacture. Since the chemical has long been used to control corrosion in other industries, established buyers have some preference on deliveries over suppliers to the drilling industry, where use began relatively recently. In this respect, a growing demand has developed in another phase of the oil industry, i.e., high-pressure gas-condensate production.

As one of the leading manufacturers of chromate recently stated in a letter to a major oil-field supply company: "The future prospects for sodium dichromate or chromate are somewhat uncertain due to the fact that our only available material is in such limited quantities, and is also somewhat complicated by the serious supply conditions on alkalies that are necessary in our operation. Limited production and heavy orders on contract customers combine to bring about this unfortunate condition."



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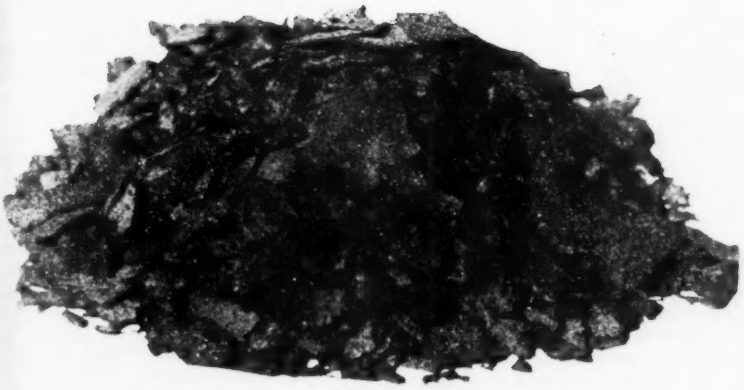
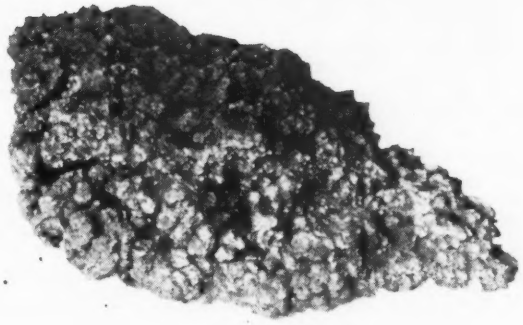


Above: Paraffin depositions that coated the interior of a stock tank in the Turkey Track pool, Eddy County (courtesy, M. G. Losee, Robert McKee Co.)

Above, right: Chemical corrosion and deposition in gas injection line, Maljamar pool, Lea County (courtesy, A. T. Wynn, Maljamar repressuring plant)



Right: Sample of deposition occurring on the overflow lines of a lease receiving tank, Empire pool, Eddy County (courtesy Baldwin-Reed Drilling Co.). The material mostly is sodium chloride, with some sulfur, calcium, and other substances. Such depositions are easily dissolved in ordinary water sufficiently pure to be used for drinking purposes

FIELD STUDIES AND DATA ON

CORROSION PROBLEMS

in Southeastern New Mexico

by J. I. Laudermilk

CORROSION of surface and subsurface equipment in the oil fields of southeastern New Mexico is a problem of major importance to the operators in this section of the state. It promises to become of increasing importance in the future since in many oil wells, and even entire oil pools, the time element has been insufficient for the full effects of corrosive action to occur. Repair and replacement of damaged equipment will be of increasing frequency and magnitude of investment unless the corrosive influence can be retarded.

Types of Corrosion Encountered

The types of corrosion encountered in the oil fields of southeastern New Mexico may be subdivided conveniently into chemical, including electro-chemical, and electrolytic.

Chemical corrosion.—Chemical corrosion appears to be the most important type existing in the oil fields of southeastern New Mexico. This corrosion is due primarily to hydrogen sulfide and water production. However, many other corrosive influences are also present. Almost all the crude oil and natural gas produced are sour, and have a large sulfur content. Hydrogen sulfide in varying amounts is present. Water from the oil producing formations is mineralized and contains relatively large amounts of corrosive substances, the more common being various compounds of calcium, bicarbonate, sodium, chlorine, and sulfur. When water production of any appreciable

THIS work presents the "field side" of studies of the problems of corrosion and related difficulties occurring in the oil fields of Southeastern New Mexico. The work was done as a public service to the petroleum industry of New Mexico. If the information and data presented herein aid in securing more satisfactory service of equipment in the field by indicating possible means of retarding corrosive influences, the primary aim of this work will have been achieved. It is hoped the information and data also may be useful to those dealing with corrosion.

magnitude occurs, severe chemical corrosion may be expected.

Electro-chemical corrosion is very minor or nonexistent on surface equipment. However, it appears to be present in many cases where corrosion of subsurface equipment occurs. In the corrosion of tubing strings, and especially in the corrosion of casing strings, it is probable that much of the corrosive action is due to electric currents generated in the metal by chemical reaction of fluids and formations on the sections of pipe passing through them and acting as a conductor. This electro-chemical action in the well would be analogous to the similar action in an ordinary wet-cell battery. Field testing has shown that for many wells there is an electric current flowing out of the wells through the flow lines of other connections on the surface. It appears reasonable that similar currents in subsurface equipment may frequently be discharged into some subsurface formation and never be indicated in surface equipment.

It is believed by the author that if chemical reactions can be retarded in the well and in the fluids produced, not only will the chemical corrosion be lessened, but much of the corrosive action which appears to be electrolytic also will be reduced.

Electrolytic corrosion.—Electrolytic corrosion of surface equipment is rare in ordinary lease installations. Important problems of this type are encountered in the longer pipe lines, when these lines pass through different kinds of soils.

An even more important consideration is that these pipe lines may act as conductors on the surface and, through the tie-in to wells, permit the electric currents transmitted to enter subsurface equipment and be discharged in subsurface formations. Where such discharges occur the equipment would be ruined by electrolytic decomposition of the metal. This appears to be a very important factor in many casing leaks.

Methods of Combating Chemical Corrosion

Methods used in oil pools in southeastern New Mexico or in pools in the Mid-Continent where similar corrosive influences have been encountered are as follows:

Stock tanks.—Five methods of combating the chemical corrosion of lease stock tanks are available. Of these, four have had sufficient field use to show satisfactory results; the fifth method also appears to be serving well.

1. **Zinc coating** of the interior of stock tanks has given very satisfactory service. Care must be taken that the coating is not broken or scratched, as this will destroy the protection of the metal.

2. **Galvanized tanks** have been used for receiving tanks when unusually severe chemical corrosion by the oil field brines has occurred. This type of tank has given very satisfactory service. .

3. **Wood tanks** are used exclusively by at least one major company on its leases. Other companies are using these in many pools.

4. **Organic coating** of the interior of stock tanks has been done successfully by spraying with commercially prepared products. In some pools, particularly in Eddy County, the crude oil tends to furnish a natural organic coating by the deposition of a thin layer of paraffin on the interior of the tanks. Although this coating will usually contain some salt, sulfur, and other chemicals it will prevent corrosion unless disturbed by blistering or abrasion. In one instance where this deposition occurred, only evidence of corrosion in the tank was on the bottom where the gager's plumb bob had cut through the coating and the fluid contacted the metal.

5. **Plastics** for coating the interior of stock tanks are a recent commercial development. They have been used some in the oil fields and appear to be serving well.

Down-the-well treatments. — From a practical standpoint, about all corrective work to date in combating chemical corrosion in southeastern New Mexico has been done in stock tanks and surface equipment on leases, and in gasoline plants and repressuring plants. However, methods of retarding chemical reactions in the well and in the fluids produced probably will give good returns on the investment involved. Hydrogen sulfide appears to be the most important cause of the chemical corrosion encountered. Three down-the-well treatments for chemical corrosion due to hydrogen sulfide are available.

1. **Formaldehyde** injected into the annulus between the casing and the tubing appears to result in greatly reducing corrosion caused by hydrogen sulfide. Barnes and Deegan[1] estimate total savings obtained from the treating costs as great as 2900 per cent are possible. They also report that field tests show that properly applied it stops corrosion 100 per cent, at least for as long as 18 months. Hefley[2] makes the following statements regarding this treatment: "The formaldehyde treatment seems to be the best thing which is commercially available for combating hydrogen sulfide corrosion. This treatment is being used extensively in the hydrogen sulfide areas of western Kansas as well as those of West Texas and New Mexico. While complete elimination of the hydrogen sulfide corrosion does not seem to be obtained with the formaldehyde treatment as it is now being practiced, it might be fair to estimate that about 50 per cent of the potential corrosion is being eliminated by this treatment."

2. **Hexametaphosphate with tannin, sodium chromate, or zinc chromate** has given satisfactory results in oil wells that are making appreciable amounts of salt water. Haltom[3] recommends this treatment under these conditions, but states that for a gas well the best treatment to prevent corrosion is formaldehyde.

3. **Caustic soda and tannic acid** have been used extensively in Kansas to combat hydrogen sulfide corrosion by down-the-well treatment. Use of this treatment in the oil fields of southeastern New Mexico has not been encountered by the author. This treatment was developed by Dr. John C Walker, of Cities Service Oil Co.

Combating Electrolytic Corrosion

Cathodic protection.—This method appears to furnish a satisfactory solution to the problems of electrolytic corrosion of pipe lines in use in southeastern New Mexico. Magnesium is now commercially available for use in cathodic protection of pipe lines and is being used by various companies in this section of the state. The use of zinc in mass also is reported to give satisfactory results. Company-fabricated devices using junk or salvaged metal are serving in some places.

Electrolytic action on pipe lines varies greatly from one area to another, probably due to the catalyzing action of different elements and compounds which may be present in minute traces in the different localities and soils. Thus, the commercial gas lines of Southern Union Gas Co. in Eddy County west of the Pecos River and in the City of Artesia are subjected to very severe electrolysis. On the other hand, lines of Lea Coun-

THE AUTHOR

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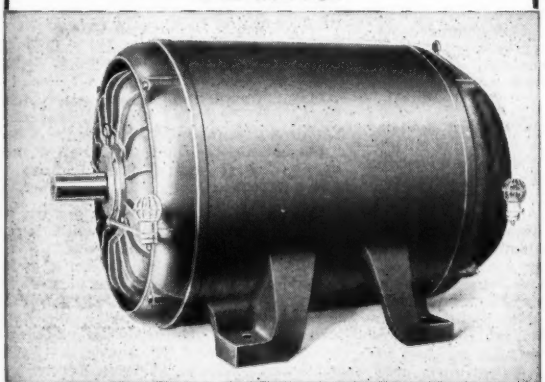

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ty Water Co. in parts of Lea County have a deposition on the exterior of the pipe. This deposition does not appear to result in any damage to the pipe, nor is there any evidence of decomposition of the metal.

The theory has been advanced that in localities where these exterior depositions are present, electro-positive action occurs and the electric current so generated is transmitted through the lines and well connections to subsurface equipment and discharged in some subsurface formation. This theory appears quite logical for field tests have definitely shown that in many wells electric currents do flow into the well through the flow lines and other surface connections.

Subsurface electrolytic corrosion.—From a practical standpoint little has been done to combat this type of corrosion, and much is still to be learned about it. Plastic couplings have been installed in some surface lines to interrupt electric currents that might be introduced from the surface. This has been a recent development in the oil fields of southeastern New Mexico and field results

Discussion of Specific Corrosion Problems and

THE following four oil pools in Eddy County and eight oil pools in Lea County contain some 60 per cent of the prorated oil wells, furnish approximately 75 per cent of the total oil production of New Mexico at the present time. Corrosion problems existing in these pools are representative of southeastern New Mexico.

EDDY COUNTY

Empire pool.—Corrosion in this pool appears to be of minor importance at the present time although there is evidence that chemical corrosive influences exist and may be troublesome in the future. No electrolysis has been reported. Deposition of salt in the producing equipment is an important problem.

It is necessary to inject fresh water into many wells periodically to "desalt" the pumping equipment. Water production is not excessive, usually varying from a mere trace to some 5 per cent of total volume of fluid produced; it carries a heavy concentration of sodium chloride.

Grayburg-Jackson pool.—Corrosion appears to be chemical. No electrolytic corrosion has been reported. Depositions in equipment are not reported to have caused trouble.

Chemical corrosion of lease stock tanks occurs when water production is encountered. This corrosion normally occurs in the bottom portion of the tanks, where water settles, has been severe enough to require special treatment. Scale accumulation on under side of the tops of steel stock tanks also is encountered but to date has not caused appreciable trouble. Chemical corrosion of receiving tanks used for the gravity separation of oil and water has been especially severe and troublesome.

Some corrosion of tubing reported in wells which produce considerable amounts of water.

Crude oil* from the Grayburg-Jackson pool showed a sulfur content of 0.95 per cent; the natural gas normally has a sulfur content of 700 to 800 grains per 100 cu. ft.

Corrective measures to combat corrosion have been centered on lease stock tanks to date. These include use of various coating materials for the tanks. Installation of galvanized tanks for receiving tanks has been reported to result in very satisfactory service.

Grayburg Repressuring-Plant System

This repressuring plant is operating most satisfactorily as regards corrosion problems. The plant has been in operation some 3 years. The old intake and injection gas lines have had no indication of corrosion to date. No replacement of any section of the lines has been made, and at present there is no indication when such replacement may be necessary in the future.

The injection gas is sweetened and dehydrated. Injection pressure of 750 psi. is used on the old lines. New lines recently installed use an injection pressure of 1,250 psi.

The following factors appear to be of major importance in the lack of corrosive troubles in this plant and system:

1. Exclusion of air from the system.
2. Sweetening of the injection gas to remove sulfur.
3. Dehydration of the gas before compression and after compression. This results in more complete removal of the water vapor and prevents or reduces any tendency of a physical chemical change of oxygen in the water vapor to some other form which may occur during compression.
4. Relatively low pressures are used on the injection lines. It is possible that the higher pressures on the new lines may result in accelerated corrosive action in the future.

Loco Hills pool.—Corrosion in this pool appears to be chemical. No electrolytic corrosion reported. Depositions in equipment are minor or nonexistent.

Chemical corrosion of surface equipment is very severe when water production is present. Steel stock tanks have been corroded entirely through on the sides. This corrosion usually occurs in the bottom sections where water settles, and to a lesser degree in the top regions. Scale accumulation on the under side of the tops of the stock tanks also exists. To date this accumulation of scale has not presented a problem.

Analyses of two samples of crude oil from the Loco Hills pool showed a sulfur content of 1.02 per cent and 1.09 per cent; natural gas normally has a sulfur content of approximately 600 grains per 100 cu. ft.

Loco Hills Repressuring-Plant System

Corrosion problems at this point appear to have been of minor importance in the past, although both chemical corrosion and depositions have been encountered.

The injection gas is sweetened to remove the sulfur. Injection pressure is approximately 800 psi.

This plant appears to confirm the experiences of other repressuring plants in southeastern New Mexico that corrosion becomes of considerable importance when pressures above 1,200 psi. are encountered in sour gas, but at lower pressures such corrosive action is greatly reduced.

Turkey Track pool.—Corrosion in this pool appears to be chemical. No electrolytic corrosion reported. Deposition in surface equipment has been noticed. However, this deposition appears to be mostly paraffin, to date has not presented any problems.

A deposition forms on the interior of lease stock tanks. When inspected in the field this frequently appears to be several inches thick in places and looks quite hard. In reality, the deposition is a thin coating, seldom more than one-sixteenth of an inch in thickness, and occasionally tends to blister. It is these blister spots which appear to be so thick. The deposition is very soft and can be readily scraped off.

Where this coating is obtained uniformly over the interior surface of the tank it prevents corrosion. It is, in effect, a natural organic coating of the metal. Where the blisters occur this protective coating is not maintained, as oxygen from the air or from the water produced, together with the other chemicals present, can attack the metal.

LEA COUNTY

Arrowhead pool.—Corrosion in this pool appears to be both chemical and electrolytic. No deposition troubles are reported.

Casing leaks caused by corrosion have been discovered, even in comparatively new wells. This indicates that the problems resulting from casing leaks will be of major importance in the future in wells not affected as yet, but subjected to the same severe corrosive influences. These casing leaks are usually encountered at depths of approximately 2,400 ft.

Corrosion of tubing is encountered. In appearance this corrosion is electrolytic. It occurs on the outside of the tubing, principally on the collars and upsets. This type of tubing trouble is reported to occur in wells that make water, and also in wells which do not produce water. In these latter cases it is possible that there may be oxygen in some form in the gas, probably as water vapor in minute traces.

Water production has increased tenfold during the past 2 years, presently amounting to about 18 per cent of the total volume of fluid produced. Crude oil analysis showed a sulfur content of 1.30 per cent.

Cooper-Jal pool.—Corrosion appears to be chemical and electrolytic, with chemical being the more important. Corrosion is not of major importance in comparison to the other problems existing in the Cooper-Jal pool. Deposition of calcium carbonate in the tubing and flow lines is one of the more serious problems encountered. However, the most important problem in this pool is the excessive water production.

Casing salvaged from wells that have been abandoned has been found to have chemical corrosion in spots on the outside of the pipe. Evidence of electrolysis also has been encountered. This normally occurs on the outside of the pipe and may be encountered throughout the casing string, thus indicating that electro-chemical action in the well

*All analyses of crude oils in this article are as reported in U. S. Bureau of Mines Report of Investigations 3660.

of such work have not been noticeable to date.

El Paso Natural Gas Co. conducted an electrolysis survey in the Langlie-Mattix pool in Lea County to determine amount and direction of flow of electric currents in the flow lines of wells. All work was done on surface equipment. It was found that where a number of wells were tied together in a compact group the electric current would flow from the majority of the wells and into a few wells of the system. Where this current was discharged underground electrolytic decomposition of the subsurface equipment would naturally result.

With electric currents in surface lines entering the subsurface equipment in many wells, it is believed by the author that installation of plastic couplings, insulated flanges, or similar equipment near the well head to interrupt these currents is well justified. If this is done, together with down-the-hole treatment for chemical corrosion, which should materially reduce electro-chemical influences, an appreciable retardation

Remedial Measures in 12 New Mexico Pools

may be the cause of much of this electrolysis. However, most of the recovered casing can be used again. Chemical corrosion of stock tanks is severe. This would be expected in view of the large water production and the many corrosive substances contained in the brines.

Deposition of calcium carbonate occurs in the tubing at depths approximately 400 ft. below the surface. Starting at this point the deposition continues through the flow lines and into the receiving tank in several instances. Normally a water production of some 30 per cent of the total fluid is necessary before deposition becomes of major importance, although it does occur in wells having a small percentage.

Corrective measures to combat this calcium carbonate deposition include the circulation of commercial preparations through the equipment to retard deposition. Also various chemicals, including sodium chromate, are injected into the annulus between the casing and tubing. When deposition sufficient to cause clogging has occurred, the lines are washed out with acid to remove the deposit.

Water production is very great. Some wells are now producing more than 99 per cent water, while many have been abandoned because of water encroachment. Nearly one-half of the total water production of the oil fields of southeastern New Mexico is in this pool.

Analyses of several samples of the crude oil show sulfur content varying from 1.55 to 1.58 per cent.

Eunice pool.—Corrosion appears to be both chemical and electrolytic. Deposition of calcium carbonate in the flow lines is encountered on many leases.

Casing leaks caused by corrosion have been discovered in several wells. These leak holes are usually encountered in the Salado salt section, at depths of approximately 1,600 to 2,200 ft. Squeeze cementing has been used for repairs in some wells.

Corrosion of tubing exists, normally occurring on the outside of the pipe. It appears to be electrolytic. Chemical corrosion has also been found on some tubing.

Calcium carbonate deposition in surface equipment is a serious problem on some leases.

Water production has increased about one-third during the past 2 years; at present it is about one-half of the total volume of fluid produced.

Analyses of three samples of crude oil showed a sulfur content varying from 1.24 to 1.37 per cent; natural gas contains approximately 300 to 450 grains of sulfur per 100 cu. ft.

Hobbs pool.—Corrosion appears to be both chemical and electrolytic. Deposition of calcium carbonate in the flow lines is encountered on many leases.

Casing leaks caused by corrosion have been discovered in many wells. These leak holes are usually encountered in the Salado salt section, at depths of 1,800 to 2,400 ft. This trouble with casing leaks appears to be distributed throughout the entire pool. There are indications that possibly 30 per cent of the wells may have casing leaks.

Corrosion of tubing exists, normally being on the outside. It appears to be electrolytic. Very little down-the-well treatment has been done.

Calcium carbonate deposition in surface lease equipment presents a serious problem to many operators.

An analysis of the crude oil shows a sulfur content of 1.45 per cent; the natural gas contains from 1,000 to 1,200 grains of sulfur per 100 cu. ft.

Lovington pool. — Corrosion encountered from both chemical and electrolytic action. However, corrosion has not caused much trouble to date, although it is probable that the full effects have not become apparent. A slight deposition, consisting mostly of salt and sulfur, is encountered, but is of minor importance at the present time.

Water production is approximately 7 per cent of the total volume of fluid produced. This production varies greatly among the wells; a maximum in excess of 50 per cent is encountered, while many wells report no water production.

An analysis of a sample of the crude oil showed a sulfur content of 1.31 per cent.

Maljamar pool.—Corrosion appears to be of minor importance. Chemical corrosion has been noticed when water production is encountered. This will be much more important when water encroachment in the wells becomes greater. Minor electrolytic corrosion of surface lines in some instances when the pipe was buried in caliche has been reported.

Analyses of two samples of crude oil showed a sulfur content of 0.85 and 0.70 per cent.

Maljamar Repressuring-Plant System

Corrosion encountered in this system appears to be chemical. It occurs almost exclusively on the inside of the pipes. Chemical corrosion is important in the gas lines when pressures on these lines exceed 1,200 psi. It is also present, but to a much lesser degree, in intake and injection lines operating at lower pressures.

Electrolytic corrosion of the outside of a gas line has been reported in one instance. In this case the pipe was buried in caliche.

Deposition in the gas lines has been encountered. This deposition is very hard, insoluble in dilute acids, and contains various compounds of iron, sulfur and salt.

A sample of a gas injection line which was destroyed by chemical corrosion is shown (page 105). Deposition inside the line was sufficient to reduce its volumetric capacity by an estimated 50 per cent when failure occurred. This line was replaced in August 1945 after having been in service approximately 3½ years. Line pressure was 1,600 psi.

Preventive measures now used to retard chemical corrosion and depositions in the lines are sweetening of the gas to reduce the sulfur content before injecting it in the wells, and a reduction of pressure on the injection lines to some 1,400 psi. Dehydration of the injection gas will be started in the near future.

Monument pool. — Corrosion encountered shows that both chemical and electrolytic types are present. Chemical corrosion appears to be the more important. Deposition of calcium carbonate is another serious problem.

Casing leaks caused by corrosive actions exist in several wells. These leak holes are usually from 1,200 to 2,500 ft. below the surface, which is the Salado salt section. Casing-leak problems appear to be distributed throughout the entire pool and are present in a considerable number of wells.

Corrosion of tubing frequently is encountered. This usually is from 1,800 to about 3,300 ft. Pits form on the body of the tubing, with some on the upsets. This corrosion appears to be caused by chemical reactions and electro-chemical action rather than a result of electrolysis. Very little down-the-well treatment for corrosion has been done.

Calcium carbonate deposition in surface equipment is a problem on many leases. Chemicals injected into the well or surface equipment to retard this deposition are used to some extent. The lines are washed out with acids when sufficient deposition has occurred to necessitate remedial work.

Plastic plug-back is succeeding in reducing water production in many cases. However, in some of the wells the oil and water seem to be so closely associated that satisfactory results cannot be obtained without excessive loss of production. In these wells it appears that the oil and water are entering the well bore through the same flow channels, and probably simultaneously.

Analyses of two samples of crude oil showed a sulfur content of 1.35 and 1.39 per cent; the natural gas has a sulfur content under normal conditions of production of approximately 750 grains per 100 cu. ft.

Vacuum pool.—Corrosion appears to be mainly electrolytic, although chemical corrosion also is encountered. The corrosive influences do not appear to be very severe, as fairly long periods of service of equipment have been reported. In some of the wells no evidence of corrosion has been found. Water production has been very small.

An analysis of the crude oil showed a sulfur content of 0.87 per cent.

of subsurface electrolytic corrosion may reasonably be expected.

Depositions in Equipment

There are four different types of depositions of importance in different pools of southeastern New Mexico. These depositions in equipment fundamentally are not corrosion phenomena, but do appear to be closely interrelated with corrosion occurrences.

Calcium carbonate deposition in tubing, flow lines and other surface equipment is encountered in various pools. It is more serious in Lea County than in Eddy County. The depositions in lease surface equipment are readily attacked by acid. A common remedial measure is to wash out the flow lines with commercial acids as soon as deposition has become sufficient to clog appreciably the lines. Injection of chemicals into the well and passages through the equipment will aid materially in retarding calcium carbonate deposition. This type of corrective work is now being done in some of the pools with satisfactory results. Several commercial products are available for retarding calcium carbonate deposition which can be secured from chemical companies and well service organizations.

Salt deposition in equipment presents a serious problem in several pools, appearing more important in Eddy County than in Lea County. The salt deposition encountered is readily soluble in water sufficiently pure to be used for drinking purposes. Most satisfactory solution is obtained by installation of a water-line system which will permit the injection of fresh water in the well and circulation through the equipment at intervals. This should be done frequently enough to prevent depositions interfering with normal production and efficient operation of the equipment. Where such water-line systems are economically unsound, the required water can be hauled to the individual well and injected. It has been the author's experience that this latter work normally is done after deposition troubles have occurred, and only rarely is it preventive instead of remedial.

Paraffin deposition is a serious problem in many wells. Many operators prefer to use mechanical means of combating this problem. However, development of chemical solvents for eliminating this trouble is in an advanced stage and commercial products now available give very satisfactory results when used for preventive as well as for remedial work. Casinghead gasoline is frequently used together with chemical solvents.

The author would like to emphasize the fact that not all paraffin depositions are harmful, but that this deposition as a thin coating is very beneficial in protecting metallic surfaces from corrosive action by salt water, hydrogen sulfide, and other corrosive influences. In some pools, chiefly in Eddy County, this protective coating is furnished by the crude oil produced.

Depositions encountered in gas injection lines of repressuring plant systems can be combated most satisfactorily by the treatment of the gas prior to injection, to eliminate water vapor and reduce sulfur content. Where sweetening and dehydration of the gas has been done consistently deposition has not been a problem.

Repair of Casing Leaks

Casing leaks are now present in many of the oil pools, particularly those in Lea County. Repair of casing leaks appears to be the major remedial work necessary at the present time; it is approached in magnitude and importance only by the problems connected with the increasing rate of water encroachment now evident in many pools. Since in the case of casing leaks it is not possible visually to determine results of remedial work, conclusions drawn from previous work of this kind are especially valuable.

Only two methods of repairing casing leaks have been used to any extent, i.e., squeeze cementing, and running an additional string of casing inside the existing corroded casing.

Squeeze cementing. — Squeeze cementing work has been done in many wells to eliminate casing leaks. However, this type of remedial work has not been very successful in obtaining desired results. Most of the casing leaks occur in the salt formations penetrated by the wells and the pressures required for squeeze cementing are sufficient to cause the cement slurry to enter into these formations. Very large amounts of cement have been used to secure satisfactory results. Successful squeeze cementing has been reported when from 2,000 to 4,000 sacks of cement have been used on the individual job.

Many of the older wells, especially in the Monument and Eunice pools in Lea County, originally were completed with such small casing that the running of an additional inner string of casing is not possible. In these wells only squeeze cementing can be used for remedial work.

Additional casing string. — It appears that the majority of operators have found the installation of an additional casing string inside the existing corroded casing string to be the more satisfactory method of repairing casing leaks. Usually a lightweight pipe will serve. Additional protection of the new pipe is secured by some operators by filling the annulus between old and new casing with a noncorrosive fluid.

Acknowledgment

The author is especially indebted for their assistance to E. C. Anderson, director, Dr. Robert L. Bates, chief, Oil and Gas Division, and Raymond Lamb, petroleum engineer, of the New Mexico State Bureau of Mines and Mineral Resources, and Glenn Staley of the Lea County Operators Committee, and also expresses appreciation in this study to assistance and cooperation of the personnel of oil companies operating in southeastern New Mexico, and several chemical companies and other engineers.

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BOOKS

THE PETROLEUM ALMANAC. A Statistical Record of the Petroleum Industry in the United States and Foreign Countries Published by National Industrial Conference Board, 247 Park Avenue, New York 420 pp. $4 paper; $5 cloth.

Entailing over a year and a half of intensive research, this volume is featured by more than 400 statistical tables showing the economic significance of the industry, its place in the nation's distributive structure, tax revenues, and the growing importance of natural gas. The almanac is divided into 10 major sections which include statistical tables and text on production, transportation, refining, marketing, distribution, utilization, finances, labor, regulatory bodies, taxation, alternate sources of energy, prices, value, and world petroleum supplies.

This convenient reference source should prove of value to industrial analysts, advertisers, students, and educators, as well as to the oil industry.

EXPLOSION AND COMBUSTION PROCESSES IN GASES. By Wilhelm Jost. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York. 621 pp. $7.50

This is a translation by Huber O. Croft, of University of Iowa, of the classic German work on jet propulsion. It presents the experimental and theoretical facts underlying explosion and combustion processes in gases. It serves as an introduction to the field, and is also of great practical value to those doing research in the various allied fields. A broad theoretical basis has been provided, as well as a detailed description of recent experimental work allowing the physical chemist to form his own conclusion independently of the theories of the author.

CHEMICAL ENGINEERING CATALOG Published by Reinhold Publishing Corp., 330 West 42nd Street, New York. 1,768 pp.

The American Institute of Chemical Engineers inaugurated this catalog in 1915 to provide a collected source of condensed and standardized data about equipment, machinery, raw material, heavy and fine chemicals, and laboratory supplies used in the industries employing chemical processes of manufacture with classified indices of such equipment and materials, carefully crossreferenced. This is the thirty-first edition of the volume, which also contains a technical and scientific books section, cataloging and describing briefly a selected list of books on chemical and related subjects.

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Formula	CH_2CHF_2
Molecular Weight	66.05
Color	Colorless
Melting Point	—117.0° C
Boiling Point	—24.7° C
Density	1.004 at —25° C
Latent heat of vaporization	137 B.t.u./lb.

vapor pressure (p.s.i. abs)

—30° C	12.0
—10° C	25.9
10° C	53.8
30° C	108.0

QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Water Flow in Coil-in-Box Equipment

How should the water be introduced and withdrawn from water boxes? We need more cooling and our boxes may not be arranged properly.—E.R.R.

Little has been written about coil-in-box equipment probably because (1) the equipment does not permit much mathematical analysis, (2) fouling or dirtying of the surface so reduces the transfer rate that other factors have very little effect, and (3) they are usually designed for ease of installation or removal or replacement of the pipe and this may interfere with other desirable features.

The introduction and removal of the water in the best possible way may not greatly alter the performance of the box. If by obtaining a more uniform flow of water or a better arrangement, the equivalent water velocity is raised from 1 to 2 ft. per second, the effect on the transfer rate is almost negligible. In the overall transfer-rate formula:

$$H = \frac{1}{\frac{1}{h_1} + \frac{1}{h_2} + R}$$

in which h_1 and h_2 are the film-transfer rates of the oil and the water, and R is the fouling resistance of the dirt on the surface of the pipe:

For 1-ft. velocity:

$$H = \frac{1}{\frac{1}{200} + \frac{1}{60} + .015} = 27.2$$

For 2-ft. velocity:

$$H = \frac{1}{\frac{1}{200} + \frac{1}{60} + .015} = 23.4$$

The increase in transfer rate from 27.2 to 23.4 does not justify much expense in rearranging the box.

The elimination of currents or bypassing of water offers more encouragement but the improvement probably will not much exceed 5 per cent. Fig. 1 indicates water temperatures measured in a cracking-still condenser box. Note that the water temperatures vary widely and that counter-current conditions of liquid flow or of heat flow are not attained. The temperatures at different levels in the box for each of the points were:

Position—	No. 1	No. 2	No. 3	No. 4	No. 5
Surface	110	..	124	116	106
6″ down	113	86	98	93	103
1′-6″ down	108	93	100	93	103
2′-6″ down	103	88	96	93	103
3′-6″ down	..	88	93	93	100
4′-6″ down	80	88	93	93	98
5′-6″ down	83	88	88	93	96
6′-6″ down	83	88	72	93	93

An upward current existed at point No. 1 and a downward one at point No. 5.

The main way of obtaining a uniform flow of water through the box is to introduce the water all along the length of the box and to withdraw it by means of a weir all along one side of the box. The exact points of entry depend upon the arrangement of the coils. Upward currents tend to develop at the part of the coil that contains the hottest oil and hence the water inlet should not be directly below the hot spot because downward currents may develop in other parts of the box whereby hot water is carried downward over large areas of the pipe surface. Nevertheless attempts to explain the currents that appear in boxes are not entirely successful. Horizontal baffles are effective in breaking up currents but their cost is usually a deterrent to their use.

Probably the most practical way to get more cooling out of a box is to conduct a systematic program of flushing and cleaning the box and pipe surface. Thus, for the transfer-rate conditions computed above, the effect of fouling factor is:

Fouling factor:	Rate
20	24
15	27.2
10	31.5
5	37.4

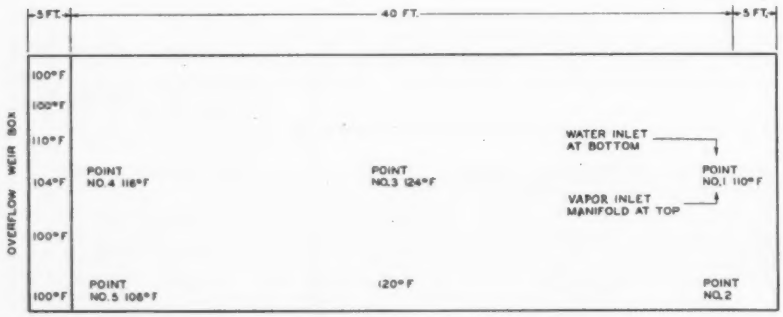

Fig. 1—Plan view of a condenser box showing water temperature. Also refer to tabulation for temperatures below surface

Sulfur in Fuel Oil

Question has arisen as to what is necessary in the ordinary laboratory and what is the approximate cost of the equipment to make sulfur analyses of fuel oils.—J.N.W.

The determination of sulfur in residual fuel oil is described fully in A.S.T.M. Standards on Petroleum Products and Lubricants (American Society for Testing Materials, 260 Broad Street, Philadelphia), Designation: D129-44 or later revisions. The bomb method described therein involves burning an accurately weighed sample in an oxygen bomb, washing out the contents of the bomb, and determining the sulfur gravimetrically by the barium sulfate method. Thus, the major equipments are an analytical balance and a high-pressure bomb along with a connecting line and pressure gage for the oxygen. These equipments cost about $500 and the auxiliary chemical equipment, such as beakers, burners, stands, etc., cost little. In addition it is desirable to employ an electric muffle furnace for drying the precipitate of barium sulfate and filter paper and to char and thoroughly dry sulfate at a red heat.

Oil Firing Temperature

In Questions on Technology, August 24, 1946, page 92, under the title "Oil-Firing Temperature," the first tabulation should read:

A viscosity of 8° Engler corresponds to:

285 seconds Saybolt Universal
31 seconds Saybolt Furol
62 centistokes
about 61 centipoises

Two other suggestions as to oil-firing temperature have come to the attention of this department. Laidlaw Drew & Co., Ltd., British manufacturers of burners, recommend heating the oil up to a temperature that will cause a viscosity of approximately 200 seconds Redwood I (about 225 Saybolt Universal). Wallsend Slipway & Engineering Co., Ltd., suggests preheating to 150° F. for fuels having a viscosity of about 750 seconds Redwood I at 100° F. (about 840 seconds Saybolt Universal).

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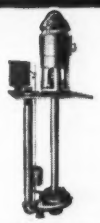
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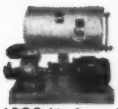
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Gas-Deviation Determinations

(Continued from page 84)

a section of this apparatus, which is made up of (1) a very accurate piston gage with weights ranging from 1/100 to 500 lb. to total 4,000 lb., (2) a steel diaphragm cell for accurate balancing of pressures and to act as a separation between the oil system of the piston gage and the gas sample in the bomb, and (3) a steel bomb, bored from each end to provide two chambers V1 and V2, to provide a means of getting pressure ratios. The chambers are in a water bath provided with stirrer, cooling coil, and electric heating coils. A pressure gage is provided on V1 chamber, a vacuum gage on V2 and a ⅛-in. needle valve and ⅛-in. tubing connects the two chambers. One-sixteenth-inch stainless steel tubing is used for all connections.

The apparatus was used in a small room at Houston, supplied with a laboratory table, a sink, an ice box, chairs, and an extra table for calculation work.

Auxiliary equipment included four sample bombs, a specific-gravity balance, wrenches, a vacuum pump, and under way is a mercury-pressure pump for returning samples to line pressure after part of the gas has been used from the bomb.

The photographs show the apparatus assembled and ready for use, or as it would be had a test been under way when the picture was taken. The net objective of the Burnett apparatus is to measure a series of pressures so as to establish pressure ratios at a constant temperature.

Dr. Harold Vance and Dr. A. B. Stevens of Texas A. & M. have had a Burnett apparatus built for their petroleum engineering laboratory. A graduate student, Lee Friedman, working with Stevens, made a series of tests and wrote his master's thesis on the use of the apparatus and the results obtained on gas from Texas fields. These tests were made at pressures ranging from zero to 3,500 lb.

Pennsylvania State College has ordered a Burnett apparatus, which is presently being made up in Tulsa.

Operation of the Burnett Apparatus in Steps

1. The apparatus is heated by water bath and by dry hot air from 125° to 130° F., with repeated pressuring.

2. The volume chambers 1 and 2 are evacuated, and gas from the sample tank is slowly pressured in to about 100 lb. This is repeated three to five times. The apparatus is cooled to test temperature before any gas is introduced. Finally Volume 1 is filled to test pressure and Volume 2 is evacuated and checked to demonstrate tight shutoff of middle valve.

3. After the temperature on the sample has been constant within +0.02 to —0.02 for an hour, the first pressure, P_o, is read by recording the barometer and the piston-gage weights required to produce on-and-off light flickers, which proves that the diaphragm cell is in midposition with the oil pressure above the diaphragm just balancing the gas sample pressure below the diaphragm. Volume 2 cell has been evacuated and remains shut in during this step.

4. The gas sample in Volume 1 is now equalized into the absolute vacuum of Volume 2. The vacuum gage should show a level reading prior to opening the ⅛-in. equalizing valve. The temperature must be right on test temperature at the time equalization takes place. A small rise or drop will occur, probably ±0.10°, but this will shortly be absorbed by the circulating water bath.

About 20 minutes are required after each expansion to equalize and stabilize the temperature. The electric heaters are used to raise the bath temperature, and circulating ice water through the coil or dropping cracked ice in small pieces directly in the bath will adjust the temperature to an exact reading.

The resulting pressure, P_1, following equalization is read from the barometer and the piston-gage weights. Each individual weight from the piston gage is listed and checked back.

5. The equalizing valve is closed; the gas in Volume 1 is exhausted to air and the Volume 2 cell evacuated to practical absolute vacuum by use of the motor-driven pump. Temperature is checked and adjusted if necessary; Volume 2 cell is closed on the vacuum; the center or equalizing valve is opened; the temperature carefully stabilized for 20 minutes and the pressure reading of barometer and piston gage is again recorded. This reading, P_2, gives the second pressure ratio.

6. A similar cycle of emptying and filling Volume 2 is continued until the pressures reach approximately 75 psia.

General Observations

Any temperature can be run from —20° to 400°. We have run 40°, 60°, 70°, 80°, and 90°.

Any pressure can be run from 0 to 4,000 lb. We have runs from 1,500 lb. on hydrogen and from 1,200 lb. on natural gas.

Any gravity of gas can be tested.

Higher temperatures are required on rich-gas samples, and oil can be substituted for water in the bath, to achieve either high or low temperature.

The apparatus is made of stainless steel and should be free of corrosion through its life. No continuing operating difficulties have been encountered with the apparatus. We have had to change diaphragm several times, but these were all due to having gotten dirt and/or packing particles into the joints in the oil system when moving and reassembling the instrument. Once it is assembled and operating on clean oil, no difficulty is had with the diaphragm.

The apparatus produces more rapid and accurate results when operated by two persons, one to handle the temperature bath controls, and the gas volume chambers, and the other to operate and balance the piston gage, barometer, and keep the test records.

If provided with automatic calculator and separate work space, the test data can be computed during the test so that final curves can be worked up with tables of factors the day following the test work.

Table 1 shows the notes on a representative test run at 70° F. on natural gas of 0.593 specific gravity.

Factors Influencing Leakage Resistance of Threaded Pipe Joints

by E. N. Kemler*

THIS paper summarizes the results of an extensive investigation made to determine the effect of thread-element tolerances, makeup, and lubricant on leakage characteristics of threaded joints. This general program was designed according to methods of statistical analysis, and the analysis carried out on the basis of these methods. The results of this investigation show: (1) Under power-tight conditions, using a thread compound similar to those used in oil-field practice, thread leakage was not found; (2) under power-tight conditions as defined in the paper, and utilizing S.A.E.-10 oil as the thread lubricant, the leakage rates had no relation to the thread elements involved. This condition indicates that further reducing of the thread tolerances would not improve the thread leakage resistance of pipe joints. These tests also indicate that thread leakage can be prevented; first, by utilization of the proper compound and, second, by proper attention to thread makeup.

The series of tests made with hand-tight conditions as defined in this

*Engineering research division, Southern Research Institute, Birmingham. The experimental work covered by this paper was done by the School of Mechanical Engineering, Purdue University, and the final analysis of the data by Southern Research Institute. From a paper presented at the annual A.P.I. meeting, Chicago, November 13.

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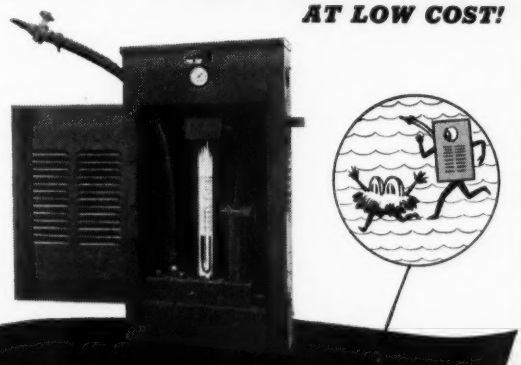

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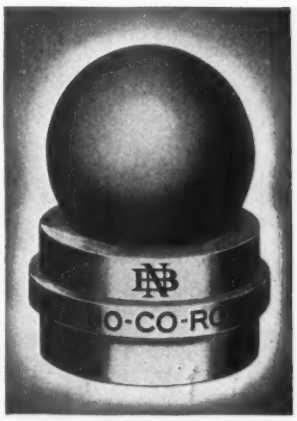

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paper indicates that the most important consideration, insofar as thread leakage is concerned under these conditions, is the type of lubricant or compound which is used. These tests also show that the rate of leakage, as determined by measuring the quantity of gas which leaks from the joint, was influenced to a lesser degree by taper, lead, pressure, and wear of chasers.

General Conclusions

The general conclusions which can be drawn from this investigation are:

1. That, for power-tight makeup conditions, the tolerance on the thread elements within the limits as covered by this investigation did not have any influence on the leakage resistance of the threaded joints.
2. The type of thread compound or lubricant used has a very important effect on the leakage resistance of threaded joints both for power-tight and hand-tight makeup.
3. Makeup conditions have a most important bearing on the effect of leakage resistance of threaded joints.
4. Although present pipe-thread lubricants do a reasonably good job insofar as improving leakage resistance is concerned, the importance which the lubricant plays in the leakage resistance indicates that lubricant manufacturers should give attention to improving those characteristics which lead to better leakage resistance.
5. The importance which makeup plays in joint tightness indicates that a careful and scientific study should be made of field practices.

Hydrocarbon Chart Available

BARTLESVILLE, Okla. — Phillips Petroleum Co. has prepared a large scale vapor pressure chart, entitled "Vapor Pressures of Twelve Four-Carbon - Atom Hydrocarbons." The hydrocarbons included are isobutane, isobutylene, 1-butene, 1, 3-butadiene, n - butane, trans-2-butene, cis-2-butene, vinylacetylene, ethylacetylene, diacetylene, 1, 2-butadiene and dimethylacetylene. Vapor pressures from 0.30 to 800 psia. are shown over a temperature range of —110° to +320° F. Single copies of the chart are available free of charge upon request on a business letterhead to Phillips' chemical - products department in Bartlesville.

Houdry Ends First Decade of Catalytic Refining Operation

NEW YORK.—Completion of the tenth year of catalytic-refining operations is being observed by officials and employes of Houdry Process Corp., Arthur V. Danner, executive vice president, explained last week.

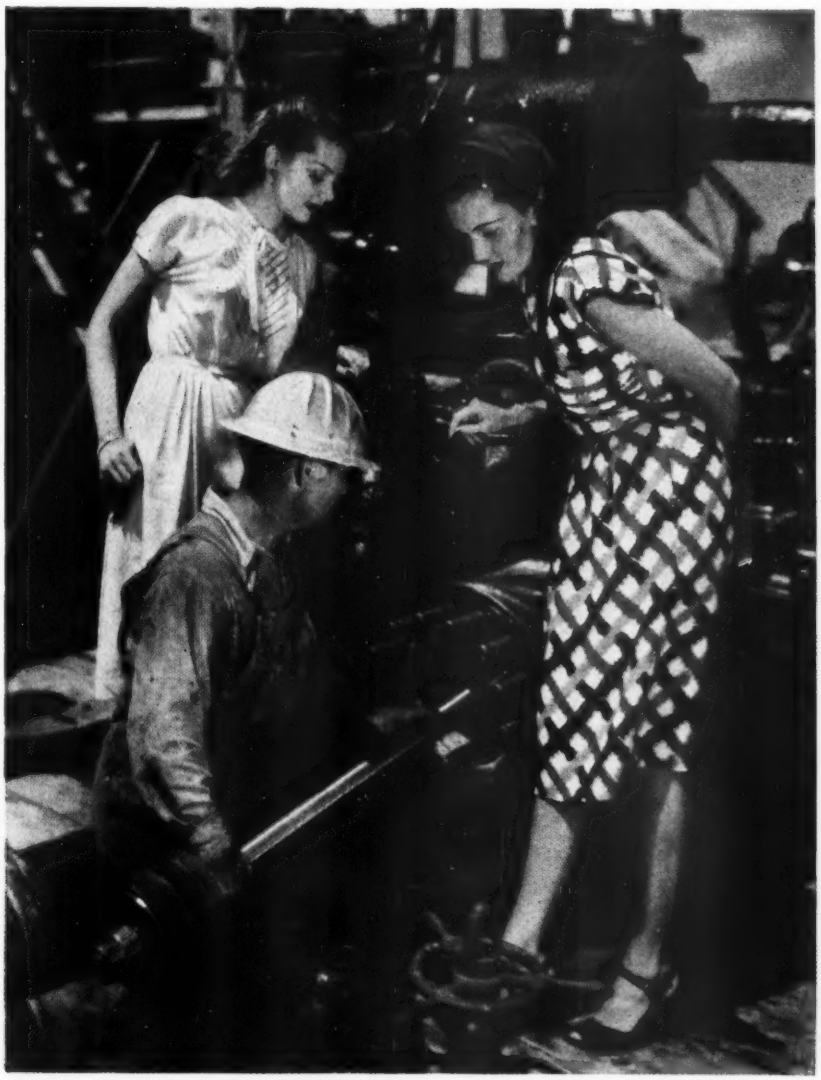
Precision Manufacture of Mission Pistons and Rods in the Mission Plant

makes for time-saving interchangebility ON THE LEASE

In previous advertisements you have seen the Mission Girls in the Mission plant demonstrating percision manufacturing under rigid inspection control. Here you see the Mission Girls on the lease observing the benefits that uniformly close-tolerance manufacturing gives. They learn why perfect fit and interchangeability of Mission Pistons and Rods saves time and makes for more efficient performance.

AMERICA'S FREE-ENTERPRISE ECONOMY GIVES THE OPTIMUM IN LIVING STANDARDS

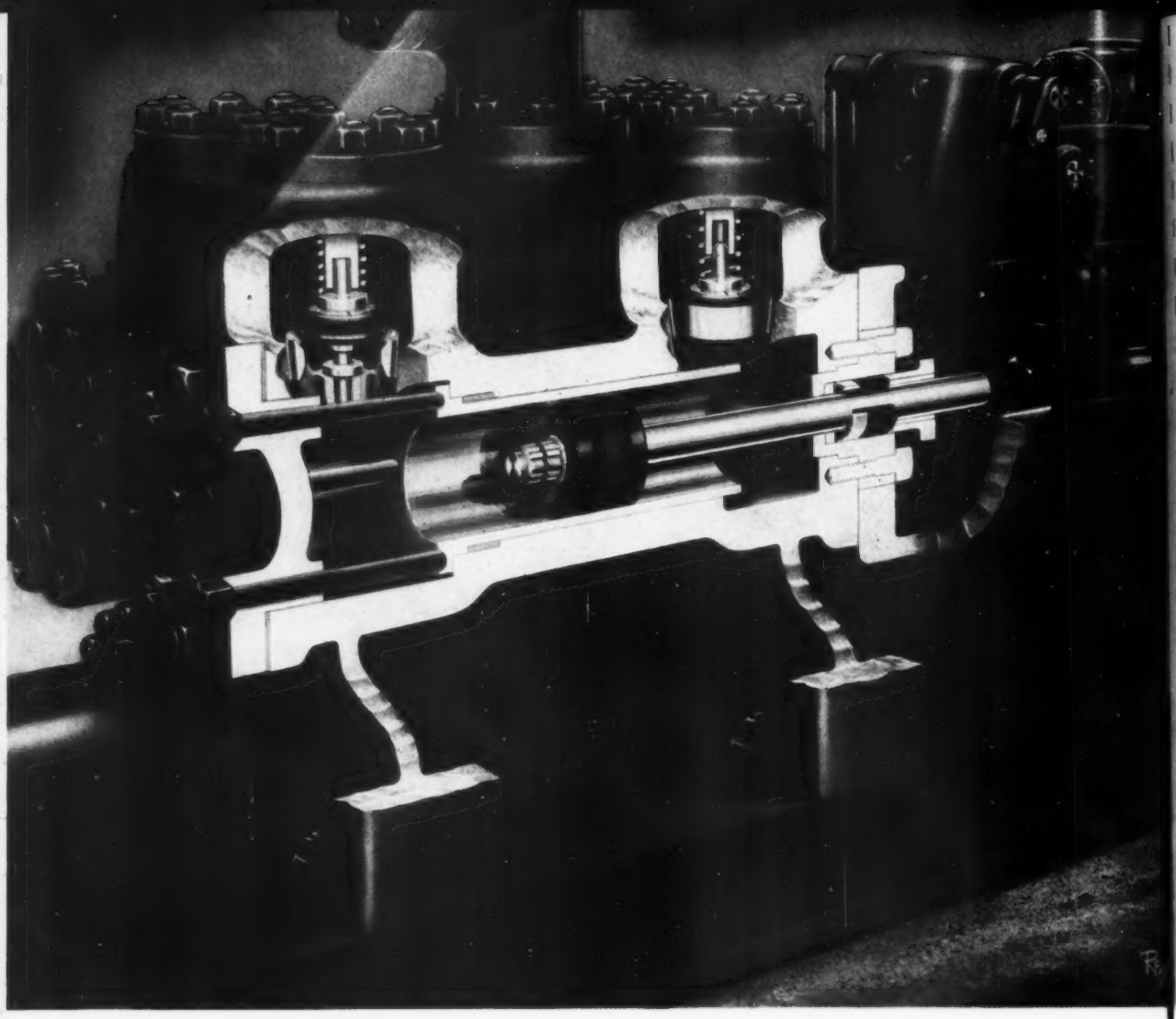
The competition of American manufacturers to outdo each other in invention and improvement, has resulted in the mass production of products unequalled by any other country in precision, utility, and appearance. This free-enterprise economy has given America the highest standard of living ever known to man.



MISSION GIRLS OF 1946 — Miss Kay Hernan and Miss Ruth Woods, famous New York Powers Models.

PHOTOGRAPHY BY HARRY PENNINGTON, JR.

Mission MANUFACTURING COMPANY



MISSION PUMP PARTS work together in your pumps to give you *more efficient slush pump performance*

MISSION *Replaceable Rubber* PISTONS

give you extra-long service. The tough, durable, specially compounded rubbers run efficiently for extremely long periods. When the rubbers are finally worn out, simply install new rubbers on the old piston body, and you are ready for another long, trouble-free run.

MISSION *Self-Sealing* GLAND PACKINGS

automatically allow pump pressure to adjust packing to correct tightness.

MISSION *Super-Surfaced PISTON RODS**

last four times longer under corrosive conditions which cause ordinary rods to pit badly. This pitting and grooving that results, quickly becomes so severe that the rods must be discarded. Mission Super-Surfaced* Rods, however, stay smooth even when salt or brackish wash water is used.

MISSION VALVES WITH *Removable Wear-Taking Bushings*

The removable bushings take the wear instead of the larger, more expensive valve seat. Compound 308** Inserts last at least twice as long as regular inserts.

* TRADE MARK, REGISTERED U. S. PATENT OFFICE

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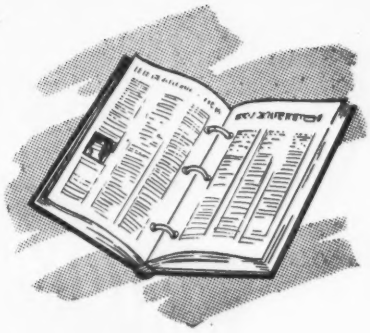
The Refiner's Notebook

A WEEKLY FEATURE OF THE OIL AND GAS JOURNAL



Caustic Solutions

Specific Gravity from 60° to 212° F.

(Also refer to The Refiner's Notebook No. 79, February 2, 1946)

Weight per cent of NaOH	Baumé	Temperature, °C. or °F.										
		59° F. 15° C.	64.4° F. 18° C.	68° F. 20° C.	86° F. 30° C.	104° F. 40° C.	122° F. 50° C.	140° F. 60° C.	158° F. 70° C.	176° F. 80° C.	194° F. 90° C.	212° F. 100° C.
0		0.9992	0.9987	0.9983	0.9958	0.9924	0.9882	0.9833	0.9779	0.9719	0.9655	0.9586
1	1.4	1.0106	1.0100	1.0095	1.0069	1.0033	0.9990	0.9941	0.9884	0.9824	0.9760	0.9693
2	2.9	1.0220	1.0213	1.0207	1.0177	1.0139	1.0095	1.0045	0.9989	0.9929	0.9865	0.9797
3	4.5	1.0332	1.0324	1.0318	1.0285	1.0246	1.0201	1.0150	1.0094	1.0035	0.9970	0.9903
4	6.0	1.0444	1.0435	1.0428	1.0393	1.0352	1.0305	1.0254	1.0198	1.0139	1.0075	1.0009
5	7.4	1.0555	1.0545	1.0538	1.0501	1.0458	1.0412	1.0359	1.0302	1.0243	1.0179	1.0115
6	8.8	1.0667	1.0656	1.0648	1.0609	1.0564	1.0517	1.0463	1.0407	1.0347	1.0284	1.0220
7	10.2	1.0778	1.0766	1.0758	1.0717	1.0672	1.0623	1.0569	1.0513	1.0453	1.0390	1.0326
8	11.6	1.0889	1.0877	1.0869	1.0826	1.0780	1.0730	1.0676	1.0619	1.0560	1.0497	1.0432
9	12.9	1.1000	1.0987	1.0979	1.0934	1.0887	1.0836	1.0782	1.0725	1.0665	1.0602	1.0537
10	14.2	1.1111	1.1098	1.1089	1.1043	1.0995	1.0942	1.0889	1.0831	1.0771	1.0708	1.0643
11	15.5	1.1222	1.1208	1.1199	1.1152	1.1102	1.1050	1.0995	1.0937	1.0877	1.0814	1.0749
12	16.8	1.1333	1.1319	1.1309	1.1261	1.1210	1.1157	1.1101	1.1043	1.0983	1.0920	1.0855
13	18.0	1.1444	1.1429	1.1420	1.1370	1.1319	1.1265	1.1208	1.1150	1.1089	1.1026	1.0960
14	19.2	1.1554	1.1540	1.1530	1.1480	1.1428	1.1373	1.1316	1.1257	1.1195	1.1132	1.1066
15	20.4	1.1665	1.1650	1.1640	1.1590	1.1536	1.1480	1.1424	1.1364	1.1302	1.1238	1.1172
16	21.6	1.1776	1.1761	1.1751	1.1699	1.1645	1.1588	1.1531	1.1471	1.1408	1.1343	1.1277
17	22.8	1.1887	1.1871	1.1862	1.1808	1.1804	1.1696	1.1638	1.1578	1.1514	1.1450	1.1383
18	23.9	1.1997	1.1982	1.1972	1.1918	1.1963	1.1805	1.1746	1.1685	1.1621	1.1556	1.1489
19	25.0	1.2108	1.2092	1.2082	1.2027	1.2021	1.1912	1.1853	1.1792	1.1727	1.1662	1.1594
20	26.1	1.2218	1.2202	1.2191	1.2136	1.2079	1.2020	1.1960	1.1898	1.1833	1.1768	1.1700
21	27.2	1.2328	1.2312	1.2301	1.2295	1.2188	1.2128	1.2067	1.2004	1.1940	1.1874	1.1806
22	28.2	1.2439	1.2422	1.2411	1.2454	1.2296	1.2236	1.2174	1.2111	1.2046	1.1980	1.1912
23	29.2	1.2548	1.2532	1.2520	1.2512	1.2404	1.2344	1.2281	1.2218	1.2152	1.2086	1.2018
24	30.2	1.2658	1.2641	1.2629	1.2571	1.2512	1.2451	1.2388	1.2324	1.2259	1.2192	1.2124
25	31.2	1.2768	1.2750	1.2738	1.2680	1.2620	1.2558	1.2496	1.2431	1.2366	1.2298	1.2230
26	32.1	1.2877	1.2860	1.2848	1.2789	1.2728	1.2666	1.2603	1.2538	1.2472	1.2405	1.2336
27	33.1	1.2986	1.2968	1.2956	1.2896	1.2835	1.2772	1.2708	1.2644	1.2577	1.2510	1.2441
28	34.0	1.3094	1.3076	1.3064	1.3002	1.2942	1.2878	1.2814	1.2750	1.2682	1.2615	1.2546
29	34.9	1.3202	1.3183	1.3172	1.3110	1.3048	1.2984	1.2920	1.2854	1.2787	1.2720	1.2650
30	35.8	1.3309	1.3290	1.3279	1.3217	1.3154	1.3090	1.3025	1.2959	1.2892	1.2824	1.2755
31	36.7	1.3414	1.3396	1.3384	1.3322	1.3258	1.3194	1.3128	1.3063	1.2994	1.2926	1.2858
32	37.5	1.3520	1.3502	1.3490	1.3427	1.3362	1.3298	1.3232	1.3165	1.3097	1.3029	1.2960
33	38.3	1.3624	1.3605	1.3593	1.3530	1.3464	1.3400	1.3333	1.3266	1.3198	1.3130	1.3060
34	39.1	1.3728	1.3708	1.3696	1.3632	1.3566	1.3501	1.3434	1.3367	1.3299	1.3230	1.3161
35	39.9	1.3830	1.3810	1.3798	1.3734	1.3667	1.3602	1.3534	1.3467	1.3398	1.3330	1.3260
36	40.7	1.3933	1.3913	1.3900	1.3835	1.3768	1.3702	1.3634	1.3567	1.3498	1.3429	1.3360
37	41.5	1.4034	1.4014	1.4000	1.3935	1.3868	1.3801	1.3733	1.3665	1.3596	1.3528	1.3458
38	42.2	1.4135	1.4115	1.4101	1.4035	1.3967	1.3900	1.3832	1.3763	1.3695	1.3626	1.3556
39	42.9	1.4234	1.4214	1.4200	1.4134	1.4066	1.3998	1.3930	1.3860	1.3792	1.3723	1.3653
40	43.6	1.4334	1.4314	1.4300	1.4232	1.4164	1.4095	1.4027	1.3958	1.3889	1.3820	1.3750
41	44.3	1.4432	1.4411	1.4397	1.4328	1.4260	1.4191	1.4122	1.4053	1.3984	1.3914	1.3845
42	45.0	1.4529	1.4508	1.4494	1.4425	1.4356	1.4287	1.4217	1.4148	1.4079	1.4009	1.3940
43	45.7	1.4624	1.4604	1.4590	1.4520	1.4450	1.4381	1.4311	1.4242	1.4172	1.4102	1.4034
44	46.3	1.4720	1.4699	1.4685	1.4615	1.4545	1.4475	1.4405	1.4335	1.4266	1.4196	1.4127
45	46.9	1.4816	1.4794	1.4779	1.4710	1.4640	1.4569	1.4499	1.4429	1.4360	1.4290	1.4221
46	47.5	1.4911	1.4890	1.4873	1.4805	1.4734	1.4663	1.4593	1.4523	1.4454	1.4384	1.4315
47	48.2	1.5006	1.4985	1.4969	1.4900	1.4828	1.4757	1.4687	1.4617	1.4548	1.4478	1.4409
48	48.8	1.5102	1.5080	1.5065	1.4994	1.4922	1.4851	1.4781	1.4711	1.4641	1.4572	1.4503
49	49.4	1.5196	1.5174	1.5159	1.5088	1.5016	1.4944	1.4874	1.4804	1.4734	1.4666	1.4596
50	49.9	1.5290	1.5268	1.5253	1.5181	1.5109	1.5038	1.4967	1.4897	1.4827	1.4759	1.4690

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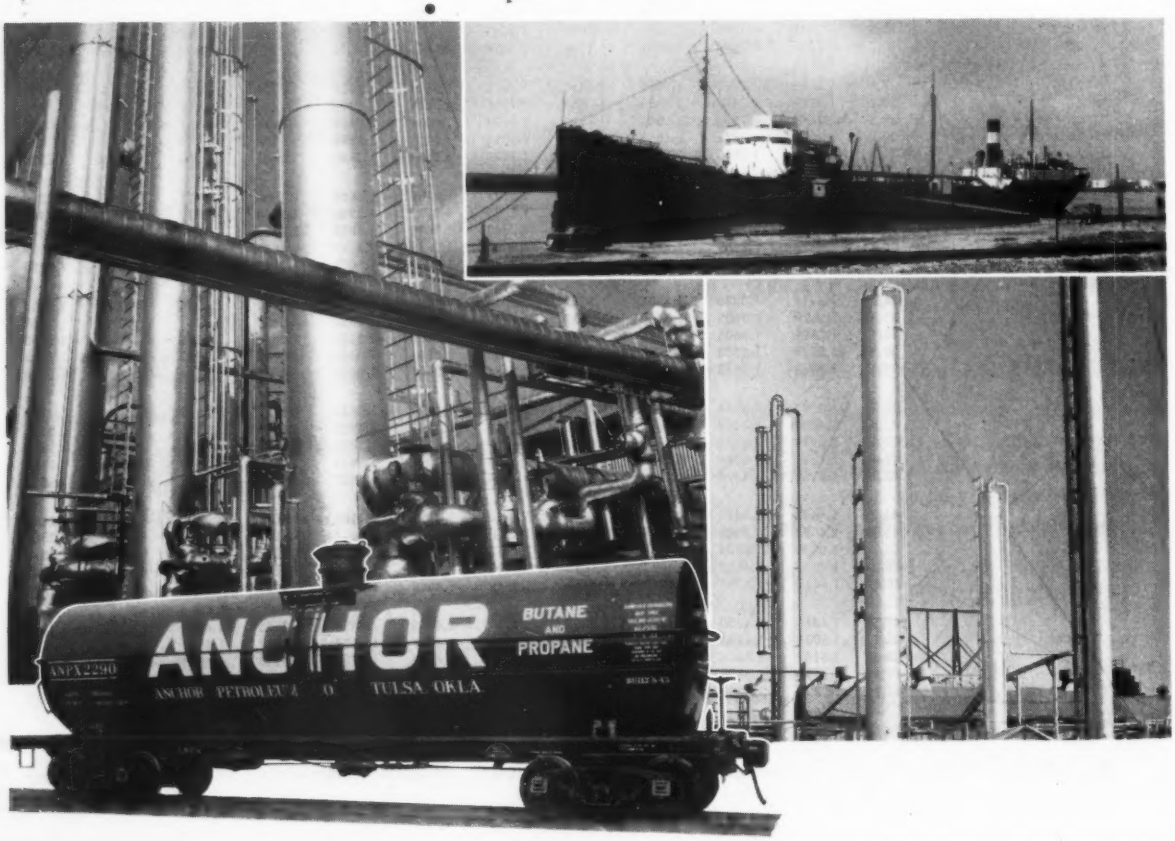


A FEATURE OF THE OIL AND GAS JOURNAL

Water Softening—Hot Phosphate Process

HOT phosphate softening is a process whereby the calcium and magnesium salts constituting the hardness of water are chemically precipitated and removed through the use of phosphate, normally disodium phosphate, in conjunction with caustic soda.' The calcium hardness is precipitated as the tricalcium phosphate while the magnesium hardness is precipitated as magnesium hydroxide. The softening operation is carried out in the hot at temperatures of 212° F. or above. Since both the calcium and magnesium precipitates formed are very insoluble, a water of practically "zero" hardness is produced by this softening process.

Use or Purpose

Hot-process phosphate softening is employed as a specific form of external treatment for boiler feed water—particularly to high-pressure boilers.

This process is applicable to very soft waters of the order of hardness not exceeding 60 p.p.m. It is particularly well adapted to turbid waters low in hardness where coagulation and softening can be brought about in a single apparatus.

Where waters are high in hardness this system may also find application by employing two-stage softening. Thus, a greater portion of the hardness may be removed economically by lime-soda softening as the first stage and the remaining hardness may be removed by subsequent phosphate softening in the second stage.

Soft waters high in silica, likewise are suited to this process. Most efficient silica reduction is accomplished in the hot-phosphate softener by magnesium sulfate. It is therefore possible to decrease silica to any desired value and at the same time accomplish softening to a "zero" hardness.

Chemistry Involved

Any of the various phosphates, from the alkaline trisodium phosphate to phosphoric acid itself may be used, depending upon the characteristics of the water to be treated. In any event, it is desired to provide an excess of 5 to 10 p.p.m. of phosphate and to maintain a pH value of approximately 9.7 to assure complete precipitation. The reactions may be represented as follows:

$$3Ca(HCO_3)_2 + 6NaOH = 3CaCO_3 + 3Na_2CO_3 + 6H_2O \quad (1)$$

calcium bicarbonate — sodium hydroxide — calcium carbonate — sodium carbonate — water

$$3CaCO_3 + 2Na_3PO_4 = Ca_3(PO_4)_2 + 3Na_2CO_3 \quad (2)$$

calcium carbonate — trisodium phosphate — tricalcium phosphate — sodium carbonate

It can be noted from Equation 1 that calcium bicarbonate is first converted to calcium carbonate which is fairly insoluble as discussed under lime soda softening. In the second equation the calcium carbonate is converted to the more insoluble tricalcium phosphate. The magnesium hardness is precipitated as the hydroxide in accordance with the following equation:

$$Mg(HCO_3)_2 + 4NaOH = Mg(OH)_2 + 2Na_2CO_3 + 2H_2O \quad (3)$$

magnesium bicarbonate — sodium hydroxide — magnesium hydroxide — sodium carbonate — water

The tricalcium phosphate and magnesium hydroxide precipitates which form are removed in the softening process by means of sedimentation and filtration.

From the above reactions it can be noted that a soluble byproduct of sodium carbonate alkalinity results, increasing the natural alkalinity from one equivalent on the untreated water to two equivalents on the treated water. Where the natural alkalinity is already high this condition is undesirable and may be offset by the use of an acid phosphate or by use of sulfuric acid. Alkalinity reduction by means of phosphoric acid is illustrated as follows:

$$Ca(HCO_3)_2 + H_3PO_4 = CaHPO_4 + 2CO_2 + 2H_2O \quad (4)$$

calcium bicarbonate — phosphoric acid — calcium acid phosphate — carbon dioxide — water

The carbon dioxide thus formed may be removed by deaeration minimizing the carbon dioxide gas content of the steam, a desirable requirement for central heating plants. The calcium acid phosphate formed is soluble and following deaeration which effects removal of the carbon dioxide, to complete the precipitation sodium hydroxide is added. This is illustrated as follows:

$$3CaHPO_4 + 3NaOH = Ca_3(PO_4)_2 + Na_3PO_4 + 3H_2O \quad (5)$$

calcium acid phosphate — sodium hydroxide — tricalcium phosphate — trisodium phosphate — water

All of the above reactions illustrate the removal of carbonate hardness. The removal of noncarbonate hardness proceeds in accordance with the following reactions:

$$3CaSO_4 + 2Na_3PO_4 = Ca_3(PO_4)_2 + 3Na_2SO_4 \quad (6)$$

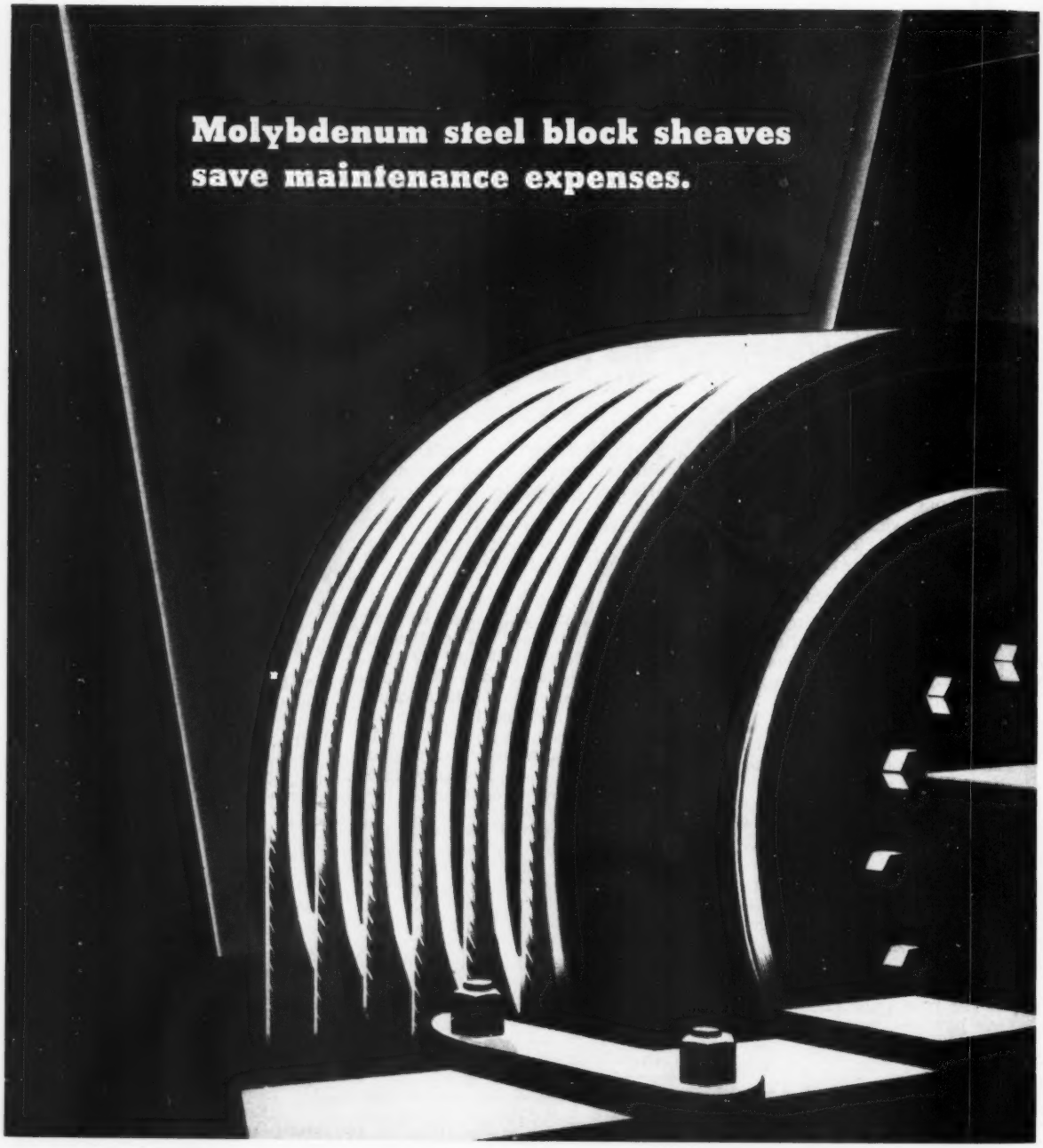
calcium sulfate — trisodium phosphate — tricalcium phosphate — sodium sulfate

$$MgCl_2 + 2NaOH = Mg(OH)_2 + 2NaCl \quad (7)$$

magnesium chloride — sodium hydroxide — magnesium hydroxide — sodium chloride

Equipment employed for hot process phosphate softening, in general, is very similar to that used in hot-process lime soda softening, although a retention period of only 45 minutes or less has been used with phosphate softening compared with the 1 hour required for hot process lime-soda softening.

This material is from the Betz Handbook for Industrial Water Conditioning, written and published by W. H. and L. D. Betz, consulting engineers, Philadelphia.



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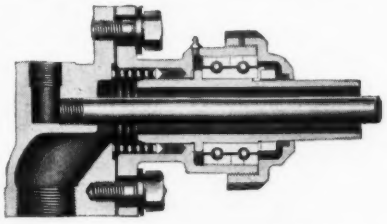
OIL AND GAS EQUIPMENT Digest

IT'S NEW ✓ CHECK IT

by John M. Spears

(1) ADJUSTABLE REVOLVING JOINTS conduct without leakage, oil, gas, or other fluids from any fixed or stationary supply pipes to rotating drums or moving members. Can be adjusted in all directions when used with

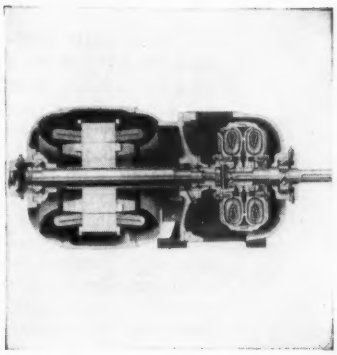


adjustable ball flange, to compensate for roll misalignment. Permits the sleeve free rotation, and therefore less wear. Pipe strains can be eliminated by loosening bolts and allowing piping union to be drawn tight. Bolts are then tightened thus eliminating necessity of joints carrying weight of the piping. *Barco Manufacturing Co.*

IT'S NEW ✓ CHECK IT

(2) SELF-SEALING TEST PLUG for closing openings in tanks, boilers, or other vessels requiring hydrostatic or pneumatic internal - pressure tests. Quick acting and self-sealed by pressure within system, which holds seal against seat, making it leakproof. Oversized tapered head on pull rod centers itself against inside edge of opening and sets up a positive resistance to pull exerted within the cylinder unit when forcing seal against its seat. Plugs are adaptable to any type of spudded, flanged, or drawn openings, either threaded or plain. *Mechanical Products Corp.*

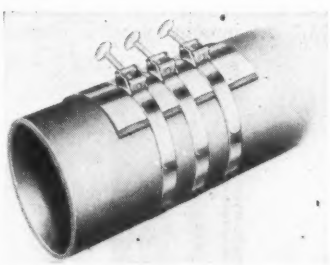
IT'S NEW ✓ CHECK IT



(3) ELECTROFLUID DRIVE consists of general-purpose a.c. induction motor flange mounted on housing containing a hydraulic coupling. Output shaft may be direct connected to driven machine through a chain, gear, or belt drive. Primary element in fluid coupling is similar to a centrifugal-pump impeller and the secondary, or output element, to a waterwheel or runner. When motor drives the impeller, it causes oil to flow through runner buckets back to impeller, thereby rotating runner through medium of oil. Torque of motor is transmitted from impeller to runner by fluid in coupling. There is no mechanical connection between the two elements of the fluid coupling. Regardless of characteristics or inertia of connected load, motor starts at no load, because at zero speed the torque-transmitting capacity of the fluid coupling is zero. Motor accelerates quickly, developing torque in fluid coupling in the ratio of the square of the speed, until sufficient torque up to maximum running torque of motor is developed to start the driven load. Shock loads from driven side are smoothed out and cannot reach the motor. *Link-Belt Co*

IT'S NEW ✓ CHECK IT

(4) PIPE-LEAK CLAMP consists of a Hycar pad which is resistant to deterioration by water, gas, oil, gasoline, etc. An annealed backing plate covers pad and can be hand-formed to desired pipe contour. Pad and patch plate are secured



The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

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over leak with stainless-steel clamps of the continuous-band type. One pipe-leak clamp for numerous pipe diameters reduces stock and eliminates necessity and expense of "fitted" clamps. *Marman Products Co., Inc.*

IT'S NEW CHECK IT

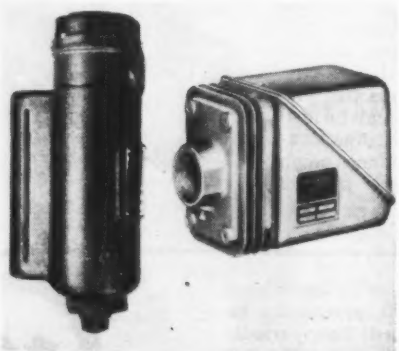
TYPE B COMPLETE

TYPE B REFILL ONLY

(5) PIPE AND TUBING WIPER has grooved cavity next to hole in wiper which allows rubber to flex and prevents stretching and tearing when pulling pipe through. Mounted in a steel ring case with rubbers to accommodate any given size pipe. Thickness of rubber at point of wear is ⅞ in. When rubber is ready to be replaced only the rubber refill is necessary. Requires but a few seconds to change refills. Type B is 14-in. o.d. for use in 15-in. and up rotary tables and any size refill up to and including 5½-in. pipe. *MacClatchie Manufacturing Co.*

IT'S NEW CHECK IT

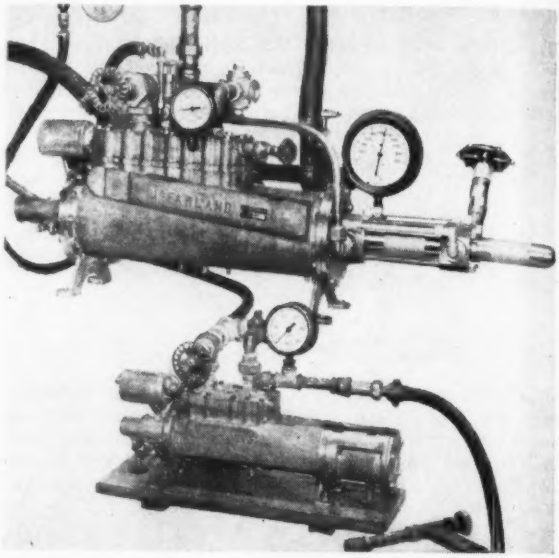
(6) FIREYE COMBUSTION CONTROL protects oil-burning equipment against hazards of flame failure and dangerously low boiler-water level. Consists of a photo-tube and amplifying system mounted directly on furnace wall. Alignment permits photoelectric cell to observe



flame through a 2-in. pipe connection, which serves both as sighting tube and support for the equipment. When flame fails, system instantly cuts off fuel or sounds an alarm. Against dangerously low boiler-water level a single probe is mounted parallel to boiler-water column and wired to the control. Bottom of probe defines the danger point below which boiler water must not fall. *Combustion Control Corp.*

IT'S NEW CHECK IT

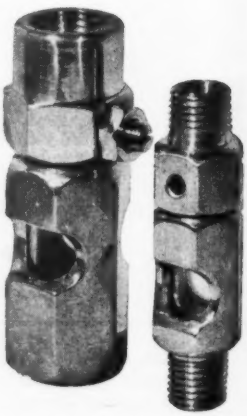
(7) HYDROSTATIC TESTING UNITS and pumps operate on water, air, gas, or steam. Units are double-acting reciprocating pumps, available with or without booster attachments. Nonsparking, may be safely used in refineries and other industries where fire and explosion haz-



ards are great. With booster (illustrated) the discharge to inlet-pressure ratios may be up to 200 to 1. Various ratios are obtained by changing cylinder and piston in booster. Main castings are high-strength aluminum bronze, resisting corrosion, erosion, and abrasion. For hydrostatic testing of pressure vessels, blowout preventer standby use, chemical proportioning, and various high-pressure work. *McFarland Manufacturing Co.*

IT'S NEW CHECK IT

(8) SIGHT FEED VALVE for oil-circulating systems where the rate of oil flow must be visually checked and regulated. In operation, oil flows past adjustable port through a valve nozzle into the sight chamber where the amount of flow can be observed. Flow adjustment is made by placing a standard key through hollow lock screw into set screw and adjusting to suit. To lock desired setting, key is withdrawn until it engages only lock screw and then is tightened. Construction consists of a sight-feed housing of hexagonal brass into which regulating unit including drip nozzle is screwed. *Oil-Rite Corp.*



IT'S NEW CHECK IT

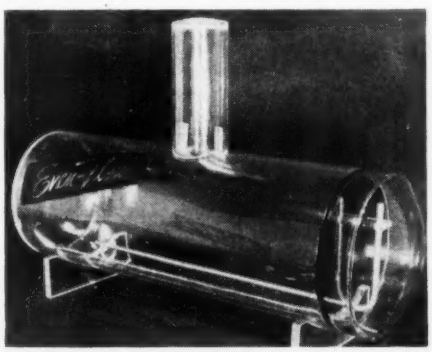
(9) NEW SWIVEL JOINT for working pressures of 12,000 psi., provides low torque and positive-packing sealoff. Rotating members are steel forgings, machined to close tolerances and with flame-hardened ball races. Full 360° rotation with low torque takes place on two rows of hardened steel balls which also serve to hold the rotating members together under preregulated pressure. No bolted flanges, locking rings, or stuffing boxes. Inside diameter is unobstructed, permitting full flow of liquids, gases, and vapors with minimum frcition loss and turbulence. End connections are of high-pressure, tapered-thread type. *Chiksan Co.*

IT'S NEW CHECK IT

(10) ELECTRIC TACHOMETER has head which consists of simple contact-making mechanism. This is connected to the indicating unit by an electric cable which may be any length up to 1,000 ft. Not of the generator type. Oscillating contacts periodically charge a condenser through a d.c. milliammeter. Circuit constants are chosen so that milliammeter does not correspond to each charge but reads the average current. Guaranteed accuracies range from ¼ to 1 per cent. Operates from 115-volt a.c. power line. No vacuum tubes or warm up required. *Metron Instrument Co.*

IT'S NEW CHECK IT

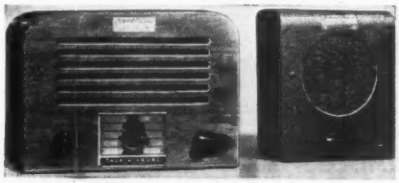
(11) PLASTIC WORKING MODELS. Transparent plastic models for demonstrational and illustrational purposes, made to exact specifications desired. May be



shaped and tinted to any form and color. Especially adaptable in working models of valves, tanks, fractionating towers, lease layouts, refineries, gasoline plants, etc. Illustration shows application in butane-tank model. *Plastic Engineering Co.*

IT'S NEW CHECK IT

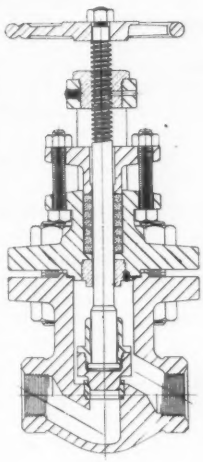
(12) TALK-A-PHONE intercommunication system simplifies office and plant communications. System consists of one master station working with as many as 10 substations. Master stations can call any one or all sub-



stations at will and receive an answer. Substation can be installed up to 2,500 ft. from master station, regardless of power availability. Silent feature shuts out excessive noise at substation locations. System includes Alnico-5 speakers, "Insta-Action" selector switch and a powerful, high-gain amplifier. Small and compact. Operates on 110-115 volts a.c. or d.c. *Talk-A-Phone Co.*

IT'S NEW CHECK IT

(13) NEW SHORT BONNET VALVE for oil, gas, steam or water service is made of drop-forged steel. In globe and gate types with screw or flanged ends. Valves range in size from ½ to 4 in. for 600-lb. service. In addition to the short compacted bonnet, features include inserted back-seat bushing of bronze or alloy steel as required, and a loose disk not having a long bearing for true alignment with stem. Globe valves have screwed-in seats while gate valve seats are rolled-in. Trim is stainless, monel, nitralloy, or stellite faced to suit the service. Globe valve in illustration is designed for steam service. *Henry Vogt Machine Co.*



IT'S NEW CHECK IT

TRADE LITERATURE

(14) CASING PROTECTORS, drill-pipe stabilizers, tools, and other items are included in manufacturer's 1947 general catalog of oil-field specialties. Includes information, specifications, installation instructions, and parts and price lists. Illustrated. Emphasizes facilitating operation through protection of men and equipment. *Patterson-Ballagh Division, Byron Jackson Co.*

IT'S NEW CHECK IT

(15) UNDERGROUND PIPE CLEANING. New pipe-cleaning service explained and amply illustrated in cleverly presented fold-out brochure. Photographs include

operation pictures, tuberculated lines, power drive, 48-in. line-scraper, scale drills, and chain heads. Line drawing depicts operation of tools within pipe to show how mud scale, sand and wax are cleaned from 2 to 72-in. pipes. *Flexible Sewer-Rod Equipment Co.*

IT'S NEW ✓ CHECK IT

(16) PENDULUM ASTROLOBE. Booklet contains technical discussion of new instrument used by oil and exploration companies for determining locations in unsurveyed regions and countries. Photographs, figures, and graphs included. Device enables operator to determine his location within 20 ft. without the aid of maps or charts. *David White Co.*

IT'S NEW ✓ CHECK IT

(17) THERMOCOUPLES. Bulletin of 34 pages describes and illustrates temperature-sensitive units for thermoelectric pyrometer installations. Graphs, cutaway dimensional drawings, and temperature-conversion tables included. Covers all types of thermocouples and accessories together with definitions and notes on alloys, insulation, connector blocks, and protection tubes. *Testing Laboratories, Inc.*

IT'S NEW ✓ CHECK IT

(18) WIRE ROPE AND FITTINGS. A comprehensive pocket-size catalog covers definitions, construction, and safeguards to longer rope life. Cross-sectional drawings with accompanying tables give dimensions, breaking strength, and list prices. Attachments, clamps, hooks and clips included. Eighty-two pages and loose-leaf bound. *John A. Roebling's Sons Co.*

IT'S NEW ✓ CHECK IT

(19) DEHUMIDIFICATION EQUIPMENT. New catalog describes and illustrates many of the standard sizes and types of equipment including Lectrobreathers for preventing entrance of moisture into storage tanks and Lectrofilters for removing oil vapor from compressed air or gases. Also lists many everyday and special uses of drying devices together with information explaining how to solve drying problems. Thirty-six illustrated pages. *Pittsburgh Lectrodryer Corp.*

IT'S NEW ✓ CHECK IT

(20) CORRUGATED ASBESTOS. Booklet illustrates and describes how corrugated asbestos fulfills functional structural requirements in field, refinery, and warehouse construction. Composed of asbestos fiber and cement, molded under pressure into unlaminated, monolithic sheets, corrugated for strength. Material can be applied to any skeleton-frame structure. *Johns-Manville.*

IT'S NEW ✓ CHECK IT

(21) ELECTRIC TIMERS. Colored bulletin covers various types of timers and relays used to automatically open and close circuits, control percentage of time at which electrical circuit can be closed or opened, and cumulatively register the total operating time or idle time on any circuit. Gives functions, uses, and models of timers of the interval, automatic reset, time delay, cycle, impulse, percentage, and multicontact types. *The R. W. Cramer Co., Inc.*

IT'S NEW ✓ CHECK IT

(22) FURFURAL. Its uses as a selective solvent, a dispersant, resin former, chemical intermediate and other miscellaneous applications are fully covered in 20-page bulletin. Gives comprehensive picture of importance of chemical to industry. Photographs and flow diagram of refining units are included. *The Quaker Oats Co.*

IT'S NEW ✓ CHECK IT

(23) PIPE FITTINGS. A 20-page catalog contains complete application information, structural data, installation procedure, temperature-pressure rating charts, specifications, and list prices of fittings for making full pipe strength, permanent, leakproof branch-pipe outlets. Also illustrates and describes drain-out fittings and complete line of flanges. *Bonney Forge & Tool Works.*

IT'S NEW ✓ CHECK IT

(24) MULTIPLE BYPASS AIRGUN. Foldout leaflet gives description, uses, and tool list of this handy, all-purpose device, weighing but 27 oz. Covers operation in either straight line, or in 90° angle position. General uses include hammer, chisel, or marking tool for smoothing, scaling, peening, and riveting. *Salsbury Tool Co. of Michigan.*

IT'S NEW ✓ CHECK IT

(25) OIL-FIELD ROLLER CHAINS is the title of a two-color pocket-size folder containing applications, construction features, and types of manufacturer's chains. Illustrations, diagrams, and tables give information on four widths of chain assemblies in standard and heavy series. Covers various chain numbers and associated pitch, roller diameter and width, pin diameter, average strength, and price. *Whitney Chain & Manufacturing Co.*

IT'S NEW ✓ CHECK IT

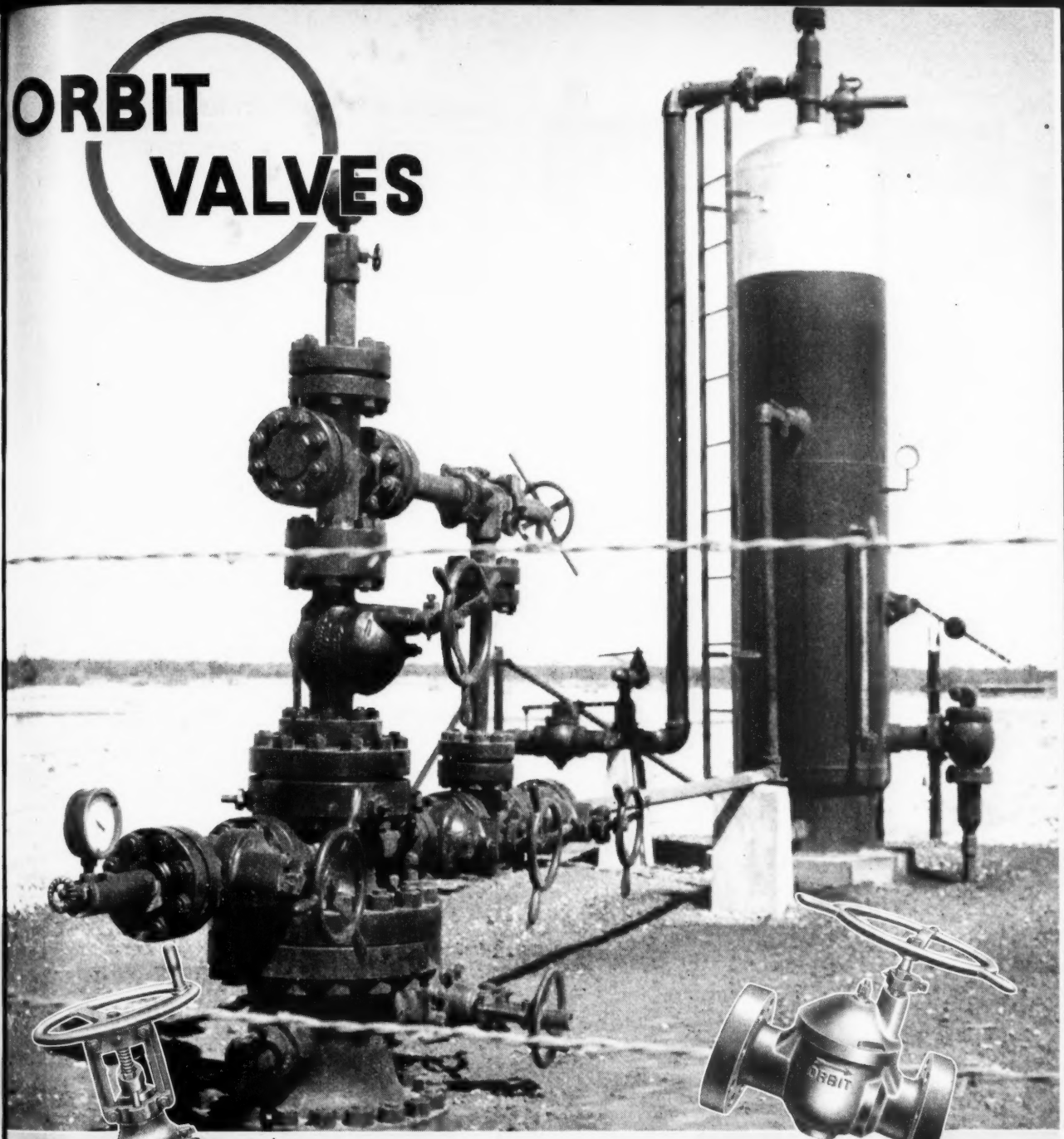
(26) WELDING MANUAL. Pocket-size manual gives practical instructions in welding, brazing, and soldering, condensed into 24 pages. Tells reader when and how to use each process—step by step. Features uses of portable welder including light cutting and burning, freeing jammed parts, burning paint, etc. *Patent Specialties, Inc.*

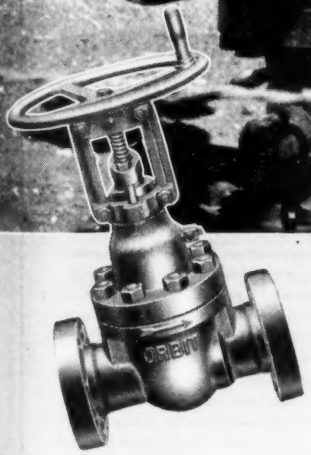
IT'S NEW ✓ CHECK IT

The Oil and Gas Equipment Digest presents a review of what is new in equipment and trade literature . . . makes it possible for readers to obtain full information on every subject by use of convenient "Check It—Mail It" service card. This periodic feature of The Oil and Gas Journal will include all that is new in equipment . . . at a time when new products are being introduced, and existing products improved.

Keep Informed. Save Time. Tear Out Card. Check It. Mail It.

ORBIT VALVES





Right: Gear Operated Master Valve. Flanged or screwed ends. Size 2" to 4". W. P. 3,000 lbs. and 5,000 lbs. *Above:* Steel Flow Line Valve. Flanged or screwed ends. Sizes 2" to 4". W. P. 500 lbs. to 2,000 lbs.

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Specify Orbit Valves on your Christmas Trees for a safer, more compact and easy operating well head unit.

FEATURES—Elimination of turbulence greatly increases life of valves. Full flow for all gases and liquids or combinations. Easy to operate, no special wrench or bar required. Positive sealing, without friction, is obtained without the use of a lubricant.

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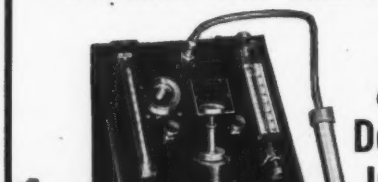

Alnor Dew Point Indicator

This precision Dew Point Indicator does not require external cooling means or auxiliary apparatus. It gives rapid, accurate determinations of dew point of any non-corrosive gas. Relative humidity, grains moisture per lb., and latent heat can also be obtained by conversion factors. Indications take place in an enclosed observation chamber under controlled conditions, reducing errors due to the human element and allowing consistent determinations by several observers.

The Alnor Dew Point Indicator has proved of great value in connection with controlled atmospheres in furnaces; for users and producers of compressed gases; with gas fuels; and in many industrial uses of air conditioning. Its simple operation and consistent accuracy encourage proper control of industrial processes wherever dew point is important. Write for Bulletin 4017.

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REFINING

New Houston Lube Plant To Be Built by Shell

SHELL OIL CO., INC., will begin construction immediately on a lubricating-oil manufacturing plant adjacent to the company's present refinery on the Houston ship channel, according to P. E. Foster, refinery manager. Cost of the new facilities is estimated at more than $10,000,000.

The plant will cover 75 acres of land in the 650-acre tract purchased last year to provide for Shell's postwar expansion program. The Government has authorized the use of the necessary materials, consisting of heavy structural steel and fractionating equipment, which will not interfere with the nation's housing program.

The new plant will be in addition to the extensive construction recently completed at the refinery which includes a 22,000-bbl. per day catalytic-cracking unit, gas recovery and treating equipment. According to Foster, the new lubricating-oil facilities will consist of five separate plants of the latest design, embodying improvements developed to meet wartime needs or resulting from wartime research. Included in the installation will be plants for vacuum distillation, deasphalting, solvent extraction, dewaxing, and chemical treating. The new refinery units, when finished, will be able to completely process high, medium, and low-viscosity indexed lubricating oils from Southwest crudes.

The construction plan includes not only full facilities for commercial manufacture of lubricating oils but also for a number of pilot plants in which improvements in lubricating-oil manufacture developed by laboratory research may be tested. Foster said contracts for construction had been awarded to the Lummus Co. and M. W. Kellogg Co.

Gasoline From Coal, Gas Object of Researchers

BIRMINGHAM, Ala.—One-third of the research efforts of Standard Oil Development Co., research organization of Standard Oil (N. J.), are being directed toward the conversion of natural gas and coal into liquid fuels, Robert P. Russell, president, told the annual meeting of the Southern Research Institute here last week.

Russell declared there is no fear of a pending oil shortage, but emphasized that the cost of finding and producing oil is increasing, whereas large reserves of natural gas already exist and the country's coal reserves are enormous.

Recent developments, Russell said,

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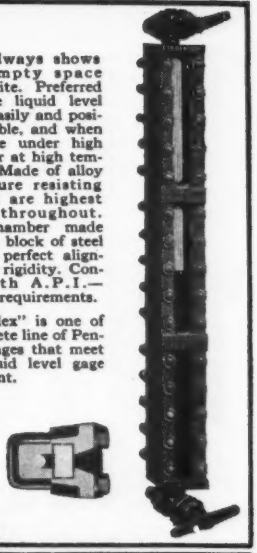
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This is a safe, efficient economical lantern that gives you a strong 1500 ft. beam or a bright floodlight. It is easy to carry, tilts and pivots, gives you lots of light where needed. Carries Underwriters' Laboratories recommendation for use in Class 1 Group D hazards. Low price. See it at once. At Oil Well Supply Stores.

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already have made gasoline derived from natural gas competitive with petroleum-derived gasoline.

The research company president told the meeting the number of new, every-day materials now being made from petroleum and natural gas "staggers the imagination." Among these, he said, are synthetic soaps of superior quality, a type of resin that can be made into thin sheets and wrapped around perishable food products, keeping them fresh during weeks of storage, and cheaper but highly effective fungicides and insecticides.

Also, he said, work now is being pushed on development of new, anti-knock gasolines that will give about 50 per cent more mileage. These, he explained, will be used in the high-compression engines of future automobiles. Automotive experts, he said, already are convinced that the cars of tomorrow can be produced at the same price of today's vehicles.

Shell's New Houston Plant To Ease Glycerin Supply

SAN FRANCISCO. — Commercial production of synthetic glycerin will be a reality when Shell Chemical Corp.'s $7,000,000 glycerin plant is completed early in 1948, according to J. Oostermeyer, president. The plant will be located in Houston. Synthetic manufacture of glycerin by a process developed in the laboratories of Shell Development Co. at Emeryville, Calif., will add to the supply now being produced by soap manufacturers, Oostermeyer said. In Shell Chemical's new plant, glycerin will be manufactured synthetically from a stable supply of propylene, chlorine, and caustic soda. According to the announcement, the plant's output will tend to steady present wide fluctuations in price and ease current shortages.

Ashland in Negotiations For Government Refinery

Ashland Oil & Refining Co. has entered negotiations with the War Assets Administration for the lease of the $16,000,000 Government-owned refinery near Ashland, Ky.

J. Howard Marshall, Ashland president, said "possible lease terms and future plans for use of certain facilities" still are "very indefinite" and declared "probable initial use will be wholly experimental."

The defense plant has a 10,000-bbl. daily T.C.C. unit, 3,000-bbl. HF alkylation unit, and a 1,300-bbl. isomerization unit. The company's present refinery has a crude capacity of 20,000 bbl. and a cracking capacity of 6,000 bbl.

With a $100,000 improvement program now under way, the refining company is reported planning to process high-octane motor fuel in the government plant.

Refining-Corporation Dividend Payments Up

WASHINGTON. — Cash dividend payments by refining companies during September totaled $46,200,000, a 12.7 per cent increase over September 1945, when dividends were $41,000,000.

Publicly reported dividend payments by all corporations in the nation were 14 per cent higher, with September payments totaling $451,800,000. Third-quarter refining-corporation dividends totaled $74,100,000, against $67,900,000 during the third quarter of 1945.

1947 Tires Will Have More Natural Rubber

WASHINGTON.—Automobile tires of 1947 will contain 35 to 50 per cent natural rubber, according to predictions of the Civilian Production Administration.

At present, tires contain about 13 per cent natural rubber and 87 per cent synthetic. The CPA rubber industry advisory committee already has approved increases in the use of natural rubber for the first quarter of 1947.

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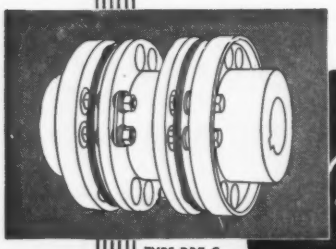
FOR HOT OIL PUMP DRIVES or any other service where 100% dependability is demanded



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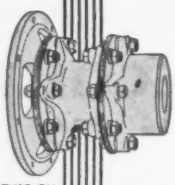

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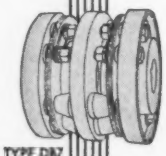

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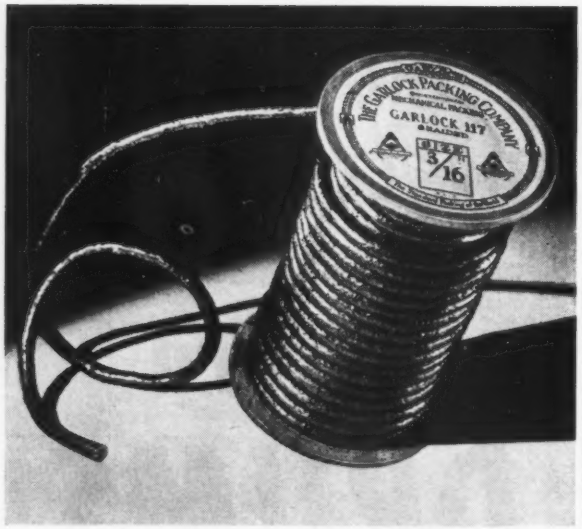

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Geograph Mechanical Well Logging Service

The excerpts below are taken from a letter recently received from Mr. J. E. Elliott, consulting geologist, of Austin, Texas:

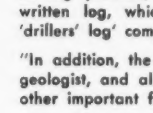
". . . Much to my surprise, I found that the drillers and crews took immediate interest in the visual record, and that the drillers made constant reference to it, using it as an aid in drilling practice, and particularly as aid in forming their written log, which naturally was more accurate than any 'drillers' log' compiled in the usual manner.

"In addition, the Geograph record was a great aid to the geologist, and allowed him to spend more time in observing other important factors of drilling and sampling.

"Finally, I wish to state that I feel the Geograph is one of the important accessories that should be on every well, and in the future, I will always insist on its use on any well that may be under my supervision."

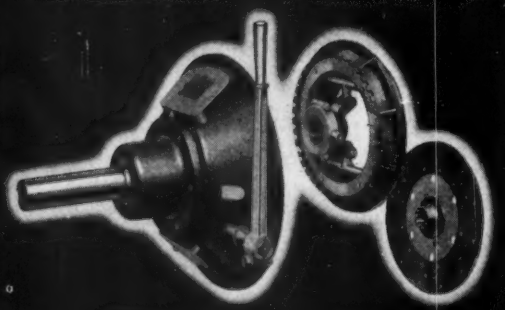
(signed) J. E. ELLIOTT.

Reasonable rental rates . . . Write for details now.



"TIME WILL TELL"
THE GEOLOGRAPH CO.
25 North Western Oklahoma City 4, Oklahoma

ROCKFORD



POWER TAKE-OFFS

- SELF CONTAINED UNIT
- WIDE RANGE OF SIZES
- CONSERVATIVE RATING
- ROLLER BEARINGS
- FINE ADJUSTMENT
- ACCURATE BALANCE
- S.A.E. DIMENSIONS

* The housing supports the drive shaft, which is mounted on a main bearing in the housing and a pilot bearing in the engine flywheel. The clutch is mounted on the drive shaft, which is extended to serve as the output shaft for the external drive, and may carry a pulley, gear, sprocket, or drive—through a coupling.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
1305 Eighteenth Avenue, Rockford, Illinois, U. S. A.

PIPE LINES

T. G. & T. Undertakes Expansion Program

TENNESSEE GAS & TRANSMISSION CO. plans to let contracts this month for feeder lines consisting of approximately 100 miles of 16-in. in the San Salvador (Texas) area.

For the big part of the expansion program authorized by Federal Power Commission for increasing T. G. & T. facilities to a total capacity of 381,000,000 cu. ft. daily, deliveries of 26-in. pipe have been arriving.

Altogether the 26-in. loops to be laid between Monroe, La., and northeast Kentucky will total 400 miles in approximately seven loops. November shipments have been received on schedule. The entire program has been estimated to cost $30,000,000.

Currently a T. G. & T. 23-mile 26-in. loop is being laid by Morrison Brothers Construction Co. near Greenville, Miss. Contracts for the remainder of this expansion project will be let in 1947 when pipe deliveries are assured at a rate which would justify putting construction gangs into the field.

During recent months, T. G. & T. has installed 18 compressor units totaling nearly 19,000 hp.: ten 1,000-hp. Cooper Bessemer; seven 1,200-hp. Clark, and one 1,000-hp. Worthington. Work is now in progress on the foundations and building at locations for stations No. 1, 3, and 5 which are to be added to the line. These will have a total of 15,000 hp.

The company is building feeder lines in Texas at the rate of 10 to 20 miles per month. In addition to the large expansion program which the company is now authorized to undertake, it has an application with FPC for permission to further enlarge the system to reach a total capacity of 600,000,000 cu. ft. daily; cost of this future project is estimated at $60,000,000.

Colorado Interstate Plans Hugoton-Denver Gas Line

COLORADO INTERSTATE GAS CO. is preparing to lay a 300-mile 20-in. natural-gas line from the Hugoton field to Denver, Colo. Work is to be done in 1947; specifications are to be issued to contractors some time within the next 2 months.

Initially the line will be equipped with 7,200-hp. compressor facilities. The line will be protected by a coal-tar enamel, glass-mat, and asbestos-felt wrapping.

During the past year the company has increased its capacity by the addition of compressor units totaling 11,000 hp. at various stations. The McClintock station with 3,200-hp. compressor equipment has been recently built near Colorado Springs, Colo.

Natural Gas Pipe Line Postpones Letting

Natural Gas Pipe Line Co. of America has postponed indefinitely the letting of a contract for 65 miles of 26-in. looping in Kansas which had been originally scheduled for December 10. This action was due to current uncertainty in obtaining pipe deliveries.

Delays in pipe deliveries are re-

WHEN YOU WANT The Best IN PIPELINE CONSTRUCTION

OKLAHOMA CONTRACTING COMPANY

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The Sign of Reliability
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Ft. Worth Tel. N 3-4100

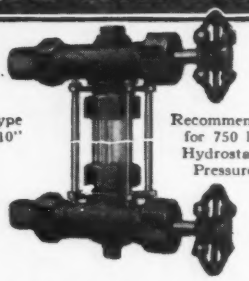
PIPE LINE SUPPLIES AND EQUIPMENT

CARDWELL AUTOMATIC RELEASE PIPE TONGS

These pipe tongs automatically release the pipe when the operator slacks the line. This eliminates the necessity of having a man in the ditch to release the tongs after the pipe has been lowered in. Oversize pads for tongs are available for handling coated pipe. Sizes are stocked to fit from 7" to 26" pipe. Other sizes are available on order.

The Clarence L. Boyd Co., Inc.
Phone 8191 LD 725
Tulsa, Oklahoma

PENBERTHY
DROP FORGED STEEL
LIQUID LEVEL GAGES



Type "10"

Recommended for 750 lb. Hydrostatic Pressure

Steel construction throughout with stainless steel interior trim. Automatic shut-off is positive and instantaneous; stainless steel balls shut off the flow of liquid when glass breaks. Heavy duty stuffing boxes, union connections, offset construction facilitate cleaning and simplify glass replacement. Conform with A.P.I.—A.S.M.E. requirements.

This is one of the complete line of Penberthy gages that meet every liquid level gage requirement.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

A Contract WITH MB MEANS PIPELINE PERFECTION

Pipeline Perfection is the result of 80 years experience among our three key men and 90% new and modern efficient equipment.

MORRISON BROS. CONSTRUCTION COMPANY INC.
GENERAL PIPELINE CONTRACTING
P. O. BOX 4106 ODESSA, TEXAS PHONE 1640

ported to have postponed the construction of an 87-mile 26-in. looping project of the company, contracted by C. S. Foreman Co., which has been engaged in recent months for laying town piping at Mendota, Creston, and Washington, Iowa.

Panhandle Eastern Lays Detroit River Crossing

Panhandle Eastern Pipe Line Co. is completing work this week for the laying of a 4,000-ft. section across the river at Detroit, Mich., which is contracted by C. S. Foreman Co. The project has been in progress for 2 months.

Pipe Lines Involved in Transportation Inquiry

Pipe lines challenge the soundness of proposals by spokesmen for railroad and financial interests that common carriers of all types—rail, air, water, pipe line—be consolidated into a limited number of transportation companies, in which it would be expected that the influence of railroad investment would predominate.

In discussing the matter in relation to postwar national transportation policy, considered in an inquiry by the House of Representatives committee on interstate and foreign commerce, it has been stated by the committee for pipe-line companies, Fayette B. Dow, chairman, that pipe-line companies are "strongly opposed to proposals which would have the effect of imposing restrictions upon pipe lines, thereby denying to the public the benefits of their superior and economical service for the purpose of attempting to protect other carriers which are inherently less efficient in the field."

Interstate Oil Line Extended in Oklahoma

Interstate Oil Pipe Line Co. is laying 17½ miles of 4-in. and 14.3 miles of 6-in. to extend the company's system to serve the Maysville, Antioch, and Katy producing areas in Oklahoma. The contractor is O. C. Whitaker Co.

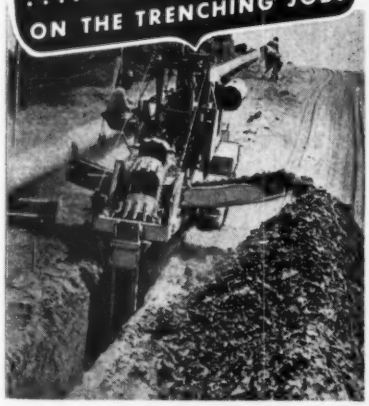
New York Natural Plans $5,250,000 Expansion

WASHINGTON.—New York State Natural Gas Corp., New York, has applied to the Federal Power Commission for permission to construct during 1947 and 1948 facilities to increase the capacity of its transmission and storage system to meet anticipated gas requirements of 15 present and potential customer companies in Pennsylvania and New York. Costs were estimated at $5,250,000.

The company proposed addition to its system during 1947 of about 70 miles of 12¾-in. and 50 miles of 14-in. line loop and about 14½ miles of 16-in. transmission pipe line in Pennsylvania to accommodate a total of 90,000,000 cu. ft. of gas daily from Hope Natural Gas Co. in accordance with a recent amendment to the contract between the companies.

The facilities planned for construction in 1948 include 21 miles of 12¾-in. loop line to be used to receive 100,000,000 cu. ft. daily from Hope.

CLEVELANDS
. . . ALWAYS OUT IN FRONT ON THE TRENCHING JOBS



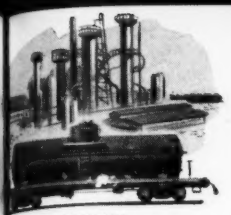
DIG IN and KEEP DIGGING

. . . with minimum times out. Make every minute count enabling the trenching gangs to keep ahead of schedules and set a fast, steady dependable pace for the rest of the crews.

That's why they are such a swell investment.

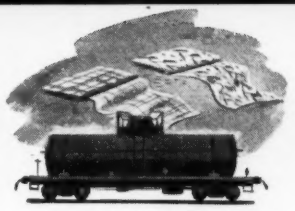
THE CLEVELAND TRENCHER CO.
20100 ST. CLAIR AVE., CLEVELAND 17, OHIO

C. S. FOREMAN COMPANY
General Contractors
PIPE LINES
217 Railway Exchange Building
Kansas City 6, Missouri



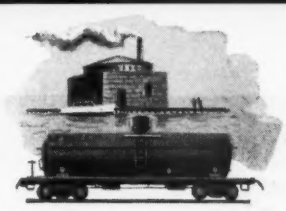
ALCOHOL

..., steel car, 6,000 to 10,000 gallon capacity.



CAUSTIC SODA

Heavily insulated steel car, with or without heater coils, 8,000 or 10,000 gallon capacity. Usually specially lined.



CHLORINE

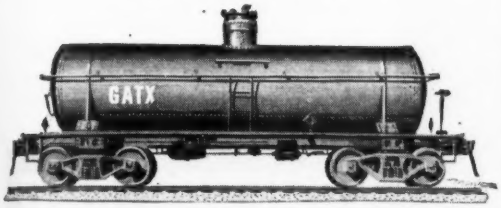
Insulated, welded car; built to withstand pressure up to 500 pounds; 15 or 30 ton capacity.

COTTONSEED OIL

Clean, steam coiled car of 8,000 gallon capacity.

FOR RENT

TANK CARS



Tank car transportation of liquids in bulk, pioneered by General American has proved its versatility, its efficiency, its economy.

The General American fleet comprises more than 37,000 specialized tank cars . . . 207 different types of tank cars . . . designed for the safe and swift hauling of an almost infinite variety of liquids.

General American's strategically located offices, plants, and repair shops keep these tank cars at your service; provide you with precisely the type of tank cars you want, *where* you want them.

If your problem is the transportation of liquids in bulk, let the nearest General American office help you.

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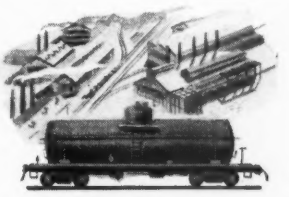
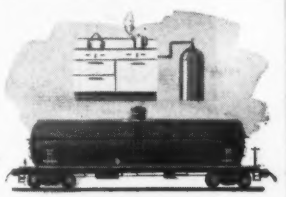


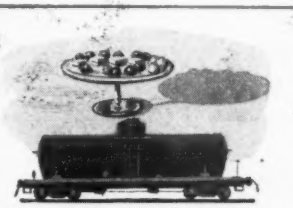
FUEL OIL

Steel car, steam coiled, 8,000 to 12,500 gallon capacity



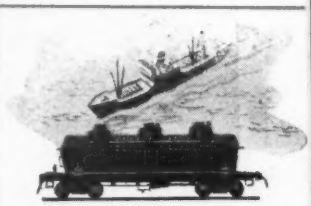
PROPANE

Heavily constructed car, welded and insulated. Built to withstand internal pressures to 300 pounds. Capacity 10,000 to 11,000 gallons.



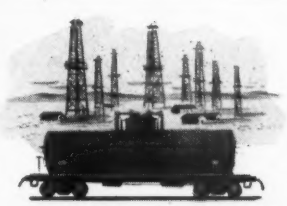
CORN SYRUP UNMIXED

Clean, steam coiled with heavy truck capacity. Usually lined with aluminum paint.



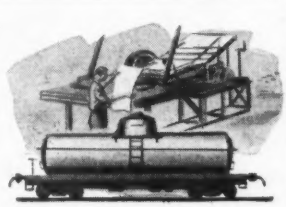
LUBRICATING OIL

Steel car, with steam coils, single or multiple compartment; usually 8,000 gallon capacity.



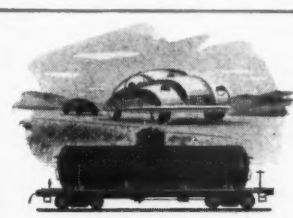
MURIATIC ACID

Car lined with pure or synthetic rubber; 8,000 to 10,000 gallon capacity.



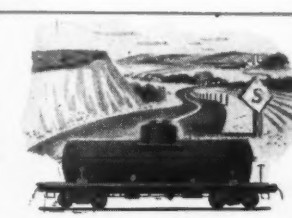
ACETIC ACID

Aluminum Car, 8,000 or 10,000 gallon capacity.



GASOLINE

Clean car, 6,000 to 12,500 gallons; single or multiple compartment.



ASPHALT OR TAR

Heavily steam coiled car; with 2 or more inches of insulation; steam jacketed outlet; 8,000 to 10,000 gallon capacity.

LARD

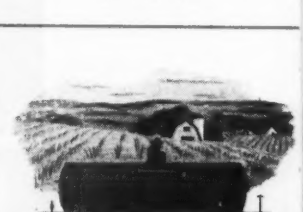
... steam coiled car, usually of 8,000 gallon capacity.

WINE

Insulated car with one to six compartments. Interior coated to preserve quality.

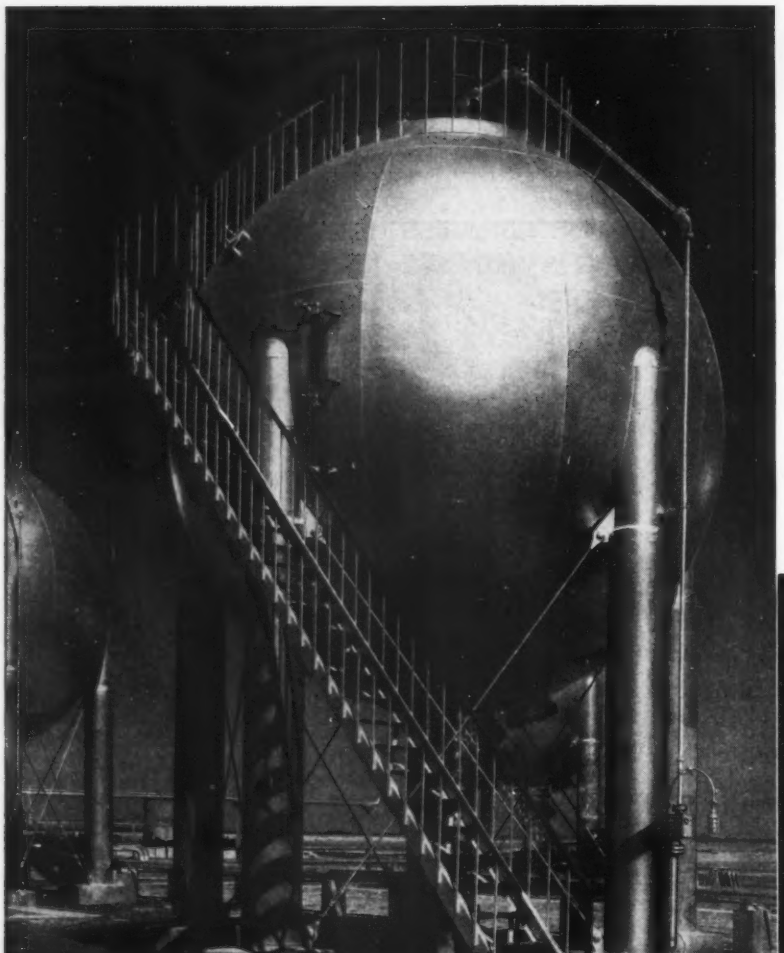
MOLASSES

Steam coiled car with heavy capacity trucks; 8,000 gallon capacity.



SULPHURIC ACID

Heavily constructed steel car with heavy truck capacity. Equipped to unload through dome.



SPHERES AND SPHEROIDS DESERVE S&J FITTINGS

When you invest in modern pressure storage facilities, it is only natural that you should want fittings of equal quality. S. & J. fittings are not adaptations of low pressure equipment; they were designed specifically for spheres and spheroids when these vessels were first introduced. They have grown up with spheres and spheroids and have been revised and refined as experience and new conditions dictated. The S. & J. line is complete. You may buy all your fittings from one source and be assured perfect fits and uniformly satisfactory performance of all individual units.

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NATURAL GAS

Storage Project Approved For Ohio Fuel Gas Co.

WASHINGTON.—The Federal Power Commission has authorized Ohio Fuel Gas Co., Columbus, to construct facilities enlarging its transmission system to receive additional natural-gas deliveries from the United Fuel Gas Co. and to store gas received from Panhandle Eastern Pipe Line Co. for delivery in peak periods.

Costs of the project were estimated by the company at $3,370,100 with some saving from salvage. Construction will be completed during 1947.

Facilities authorized include an underground natural-gas storage project in Lorain and Medina counties, Ohio, to be known as the Wellington storage project, construction of a 2,000-hp. compressor station in Lorain County, a 2,400-hp. compressor station in Lawrence County, and about 88 miles of 16-in. gas-transmission lines in Lorain, Fairfield, Licking, and Knox counties. The Wellington project will consist of three pools covering about 5,225 acres.

These gas-producing pools in Wellington field are to be converted, starting in the spring of 1947, to a repressured underground storage area by pumping gas from the company's general transmission system into the wells to the original rock pressure, this giving them a calculated storage capacity of 6,000,000,000 cu. ft. above remaining reserves. United Fuel has agreed to supply an additional 25,000,000 cu. ft. of gas daily at the Kenova connection with Ohio Fuel during 1946 and 1947, and Ohio Fuel will increase its transmission of gas from Wellington field by 6,000,000 to 8,000,000 cu. ft. per day during 1946-47.

Sales of Natural Gas 9.8 Per Cent Over 1945 Figure

Natural-gas sales in October totaled 1,795,848,000 therms, a gain of 9.8 per cent over October 1945, despite the fact that total degree days in natural-gas territory were 23.9 per cent lower than in 1945, according to the monthly report of the American Gas Association.

The association's index for October stood at 180 per cent of the 1935-39 average. For the 12 months ending October 31, sales of natural gas were 22,648,935,000 therms, a decline of 0.9 per cent from the previous year's sales of 22,865,257,000 therms.

Sales of utility gas of all types to ultimate consumers in October totaled 2,041,981,000 therms, a gain of 9.7 per cent over 1945 October sales of 1,861,458,000 therms. Index of total utility sales stood at 174.7 per cent of the 1935-39 average. For the 12 months ending October 31, sales were 26,022,092,000 therms, a drop of 0.4 per cent from the sales figures of 26,133,231,000 therms of October 1945.

Construction to Start On Mississippi Gas Line

JACKSON, Miss.—Construction of a natural-gas pipe line to serve nine Mississippi towns is expected to begin immediately.

The line, 86 miles of 6-in. pipe, will run from the Jackson compressor station of the United Gas Pipe Line Co., which will build the line, to Philadelphia, in Neshoba County.

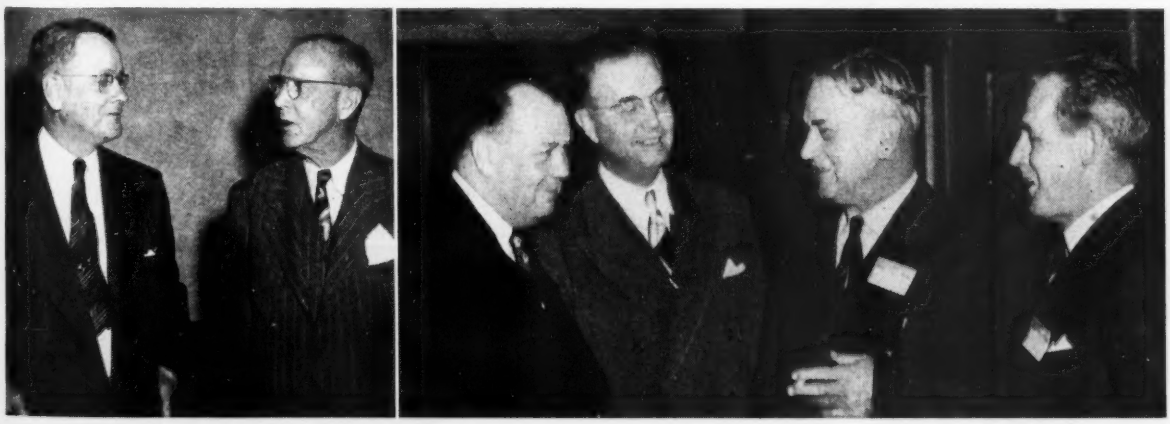
Natural Gasoline

Natural Gasoline Stocks, Production Show Gains

WASHINGTON.—Daily average production of natural gasoline and allied products increased 2,000 bbl. to 314,000 bbl. in September, according to a report compiled by the Bureau of Mines. Substantial increases in Oklahoma, East Texas, the Panhandle, and Louisiana Gulf were offset partly by decreases in inland Louisiana and California.

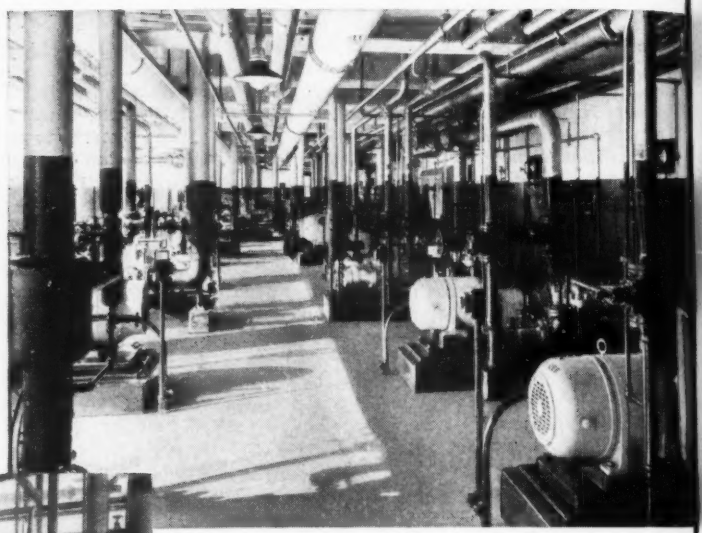
Total stocks increased 117,000 bbl. over the August figure of 6,943,000 bbl. to 7,060,000 bbl. in September. Refinery stocks in September were 2,157,000 bbl., compared to 2,096,000 bbl. in August, and stocks at plants and terminals totaled 4,903,000 bbl. against 4,847,000 in August.

Demand at plants for natural gasoline and allied products totaled 9,627,500 bbl. in September, against 10,183,810 bbl. in August and 8,322,738 bbl. in September 1945.

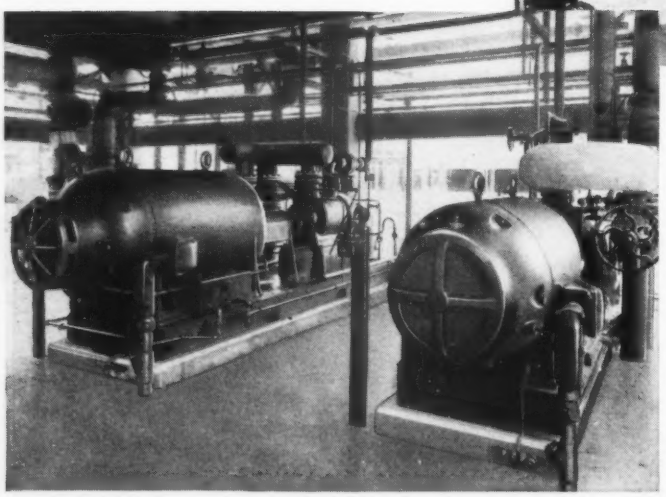


Fred W. Peters, treasurer, Oklahoma Natural Gas Co. and new treasurer of the Independent Natural Gas Association of America, is shown in the picture at left talking in Fort Worth with the association's new president, Joseph W. Bowes, right, president, Oklahoma Natural Gas Co. Among the association's directors at the recent annual meeting in Fort Worth, shown in the second picture, were: D. A. Hulcy, president, Lone Star Gas Co., Dallas; C. H. Zachry, president, Southern Union Gas Co., Dallas; H. W. Long, royalty owner, Amarillo; and W. H. Wildes, president, Republic Natural Gas Co., Dallas. At the meeting, the association reelected Paul Kayser, president, El Paso Natural Gas Co., first vice president; J. H. Dunn, president, Shamrock Oil & Gas Co., second vice president; John A. Ferguson, Washington, executive director; and Wesley E. Disney, Washington, general counsel

You don't fence 'em in...



Main pump room in a refinery. The pumps are driven by G-E totally enclosed, fan-cooled, squirrel-cage induction motors ranging in size from 25 hp to 250 hp, 3000 rpm.



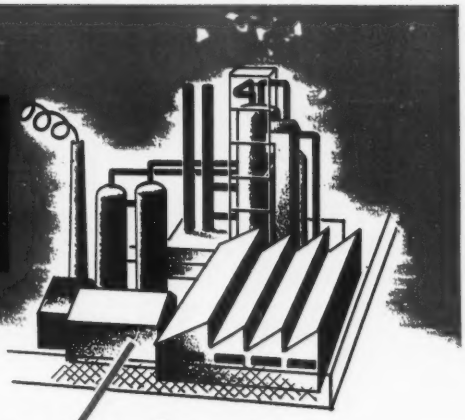
Tutwiler Refinery of the Cities Service Oil Company at Lake Charles, La.—Two large, totally enclosed, fan-cooled, explosion-proof, squirrel-cage induction motors, each coupled to a centrifugal pump. The motor at the left is a 600-hp, 3600-rpm Type K, and the one at the right is a 500-hp, 3600-rpm Type K-6339Z.

GE

MOTORS AND CONTROL

For Hazardous Areas

You don't fence 'em out!



You put these explosion-proof motors and controls right on the spot in hazardous areas. No costly vaults, no awkward remote drives are needed to meet refinery hazards.

YOU save engineering time and construction costs on your refinery-expansion projects when you make the widest possible use of explosion-proof electric equipment. You'll eliminate the need to plan and build costly "isolation wards." You'll avoid the necessity for clumsy remote-drive arrangements. You'll simplify subsequent plant maintenance.

Use of G-E explosion-proof motors and controls, applied with the aid of experienced G-E application engineers, can also mean lower insurance costs and greater protection against unscheduled shutdowns. For you will have the very best in electrical safety. Whether it's gasoline, naphtha, or natural gas, there is a practical way to solve your problem with a combination of G-E motors and control. General Electric builds America's most complete line of motors and control devices for use in both Class I and Class II locations.

G-E engineers, specializing in refinery applications, will gladly work with you to get the best combination of safety, economy, and operating convenience in your electrical layouts. They can be reached quickly through the G-E office in your area.

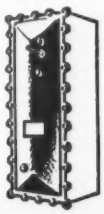
Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

G-E Explosion-proof Equipment for Refineries

G-E Motors—Available types include squirrel-cage, wound-rotor gear-motors, brake-motors, and motor-generator sets in sizes ranging from fractional-hp to 1000 hp, 3600 rpm.

G-E Vertical Motors—Provide extra security in pumping liquids from underground tanks. Nonsparking ratchet prevents reverse rotation and damage to pump. Most types and ratings available in horizontal explosion-proof motors can be had in vertical motors.

G-E Air-break Starter—This combination starter is available in magnetic or manual types for full- or reduced-voltage starting, from 1 to 100 hp.



G-E Oil-immersed Starter—This highly protected unit may be had in ratings from 5 to 3500 hp for full- or reduced-voltage starting.

GENERAL ELECTRIC

STATISTICS and

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 30, 1946

	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1946				
	Comp.	Oil	Gas	Dry	Footage	1946	1945	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	28	14	0	*14	39,326	1,450	1,357	0	0	0	0	0	0	0	0	0	0
Pennsylvania	72	39	5	†28	112,433	3,647	3,723	0	0	0	0	0	0	0	0	0	0
West Virginia	17	2	14	1	51,451	695	746	0	0	0	0	0	0	0	0	0	0
Ohio	28	4	17	7	90,706	1,169	910	0	0	0	1	1	3	0	13	39	55
Indiana	6	4	0	2	13,394	343	181	0	0	0	0	0	4	0	0	18	22
Kentucky	13	4	6	3	34,120	433	530	0	0	0	2	2	7	0	0	37	44
Illinois	31	14	0	17	75,004	2,116	1,670	0	0	0	5	5	52	0	1	422	475
Michigan	18	7	6	5	40,900	749	697	1	0	2	3	6	21	0	10	238	269
Kansas	37	22	0	15	125,130	1,831	1,619	0	0	0	11	11	27	0	2	253	282
Neb., Mo., Iowa	0	0	0	0	0	19	28	0	0	0	0	0	0	0	0	14	14
Oklahoma	57	23	6	28	186,626	2,751	2,215	2	0	1	15	18	88	0	37	362	487
Texas	151	95	13	43	693,369	7,196	6,506	3	1	0	19	23	199	27	32	1,187	1,445
North Central	34	20	1	13	99,026	2,513	2,022	1	0	0	6	7	71	0	4	484	559
West	45	33	1	11	187,672	1,620	1,612	1	0	0	4	5	47	0	1	162	210
Panhandle	4	3	1	0	10,757	288	504	0	0	0	0	0	0	0	0	5	5
Eastern	10	5	3	2	50,581	642	350	0	0	0	0	0	44	22	13	231	310
Gulf Coast	40	25	7	8	279,602	1,591	1,541	1	1	0	3	5	18	3	5	100	126
Southwest	18	9	0	9	65,731	542	477	0	0	0	6	6	19	2	9	205	235
Louisiana	37	27	1	9	233,536	1,296	1,001	0	0	0	3	3	45	13	7	173	238
Northern	18	11	1	6	75,820	736	434	0	0	0	2	2	9	0	2	95	106
Southern	19	16	0	3	157,716	560	567	0	0	0	1	1	36	13	5	78	132
Arkansas	5	4	0	1	22,717	166	166	1	0	0	1	2	8	0	0	36	44
Mississippi	9	7	0	2	66,706	232	339	0	0	0	2	2	1	0	1	63	65
Southeastern States	2	0	0	2	5,493	41	56	0	0	0	2	2	1	0	0	34	35
Montana	6	0	4	2	12,009	298	293	0	0	0	2	2	10	0	4	31	45
Wyoming	3	3	0	0	14,033	157	210	0	0	0	0	0	12	0	3	34	49
Colorado-Utah	8	8	0	0	50,765	152	51	0	0	0	0	0	4	0	0	16	20
New Mexico	12	6	5	1	45,400	370	385	0	0	0	0	0	4	0	0	36	40
California	18	9	1	8	97,680	1,372	2,059	0	0	0	8	8	27	0	5	207	239
Total United States	558	292	78	188	2,010,798	26,483	24,742	7	1	3	74	85	513	40	115	3,200	3,868
Total previous week	577	283	67	227	1,881,360	25,925	24,200	7	0	0	83	90	506	39	112	3,126	3,783
Total Dec. 1, 1945	542	282	55	205	1,771,363			7	0	2	72	81	480	22	126	3,187	3,815

Service wells included: *14, †28.

MARKET QUOTATIONS

GRAVITY SCHEDULES

Top prices include all gravities above grades designated, and low prices include all gravities below grades designated:

Gravity—	Signal Hill, Calif.	Oklahoma, Kansas	Gulf Coast Tex.*	West Tex.†
18-18.9	$1.17			
19-19.9	1.21			
20-20.9	1.24	$1.30		$1.17
21-21.9	1.28	1.32		1.19
22-22.9	1.32	1.34		1.21
23-23.9	1.35	1.36		1.23
24-24.9	1.39	1.38	$1.61	1.25
25-25.9	1.43	1.40	1.63	1.27
26-26.9	1.46	1.42	1.65	1.29
27-27.9	1.50	1.44	1.67	1.31
28-28.9	1.54	1.46	1.69	1.33
29-29.9	1.57	1.48	1.71	1.35
30-30.9	1.61	1.50	1.73	1.37
31-31.9		1.52	1.75	1.39
32-32.9		1.54	1.77	1.41
33-33.9		1.56	1.79	1.43
34-34.9		1.58	1.81	1.45
35-35.9		1.60	1.83	1.47
36-36.9		1.62	1.85	1.49
37-37.9		1.64	1.87	1.51
38-38.9		1.66	1.89	1.53
39-39.9		1.68	1.91	1.55
40 and above		1.70	1.93	1.57

*For crude from Daboval, El Campo, and Sandy Point. †Includes Lea County, New Mexico.

(Quotations shown here are f.o.b. plant in tank cars and in cents per gal. as of last Monday.

REFINERY GASOLINE

Octane (A.S.T.M.)	78-78½†	73-75
Mid-Continent*	7.375-7.625	6.625-7.000
Tex. Gulf Coast	7.250	6.500-6.750
New York Harbor	9-10.75	8-9.25
California		6.250-6.750

*Basic Oklahoma Group 3. †1939 C.F.R. (research method).

NATURAL GASOLINE

Grades—	26-70	18-5*
Oklahoma (Group 3)	5.000	6.000
N. Texas (f.o.b. plant)	4.250	5.100
N. Louisiana (f.o.b. plant)	4.500	5.400
California (averages)	5.500	6.250

CRUDE-OIL PRICES

Representative posted schedules per bbl.

East Texas	$1.70
Kettleman Hills, California*	1.69
Beauregard Parish	1.65
Illinois Basin	1.82
Pecos County, Texas (Yates)	1.40
Bradford, Pennsylvania	3.41
Eastern Ill., and Western Ind.	1.67

Note: Crude prices exclusive of subsidy.

A.P.I. REFINERY REPORT

Week ended November 23, 1946
(Figures in thousands of barrels)

	Daily crude runs to stills	Stocks— Gasoline	Distillate	Residual
East Coast	735	19,218	24,313	11,615
Appalachian	165	3,243	737	653
Ill., Ind., Ky.	754	15,212	8,481	5,325
Okla., Kan., Mo.	386	8,579	3,522	1,378
Inland Texas	223	3,330	598	842
Tex. Gulf Cst.	1,096	13,785	10,996	7,822
La. Gulf Cst.	330	4,051	4,234	2,333
No. La., Ark.	59	1,859	481	203
Rocky Mtn.	122	1,676	550	674
California	751	16,493	12,631	29,220
Total 11-23-46	4,621	87,446	66,543	60,065
Total 11-16-46	4,716*	88,007	67,221	60,552
Total 11-24-45	4,563	83,823	45,843	46,199

*Revised by Bureau of Mines.

CRUDE-OIL STOCKS

(Bureau of Mines Estimate)

Week ended—	Bbl. of crude*
November 16, 1946	221,670,000
November 9, 1946	221,302,000
November 17, 1945	220,503,000

*Excludes unrefinable Calif. stocks.

TRENDS

DAILY AVERAGE PRODUCTION FOR WEEK

	Nov. 30 crude oil	B. of M. Nov. demand	Nov. 23 crude oil
Alabama	1,000	1,200	1,000
Arkansas	79,100	77,000	78,900
California	870,000	850,000	872,800
Colorado	38,810	32,000	38,070
Eastern	65,000	64,200	68,500
Florida		200	
Illinois	205,150	212,000	202,200
Indiana	19,600	19,000	18,800
Kansas	275,500	263,000	280,700
Kentucky	30,000	29,000	30,050
Louisiana	407,950	382,000	407,700
North Louisiana	98,600		98,350
South Louisiana	309,350		309,350
Michigan	43,265	46,000	48,200
Mississippi	80,550	60,000	79,000
Montana	24,730	24,000	23,490
Nebraska	750	800	750
New Mexico	100,500	99,000	100,500
Oklahoma	367,500	383,000	366,900
Texas	2,096,750	2,090,000	2,096,750
District 1 (Southwest)	19,000		19,000
District 2 (Southwest)	147,200		147,200
District 4 (Southwest)	226,300		226,300
District 3 (Gulf Coast)	464,300		464,300
District 5 (Eastern)	36,850		36,850
District 6 (Eastern)	105,100		105,100
East Texas field	324,000		324,000
District 7C (West)	29,500		29,500
District 8 (West)	507,250		507,250
District 7B (W. Central)	35,300		35,300
District 9 (N. Central)	121,400		121,400
District 10 (Panhandle)	80,550		80,550
Wyoming	103,190	97,000	102,210
Miscellaneous		600	
Total United States	*4,809,345	4,730,000	4,816,520
Change from prev. week	down 7,175		

Total production January 1-November 30 ..... †1,587,936,144 bbl.
Same period last year (crude, plus condensate) 1,565,186,025 bbl.
*Not incl. 23,350 bbl. condensate. †Incl. 8,021,250 bbl. condensate.

CRUDE-OIL STOCKS 221,670,000 bbl. as of November 16—up 368,000 bbl. One year ago 220,503,000 bbl.

GASOLINE STOCKS 87,446,000 bbl. as of November 23—down 561,000 bbl. One year ago 83,823,000 bbl.

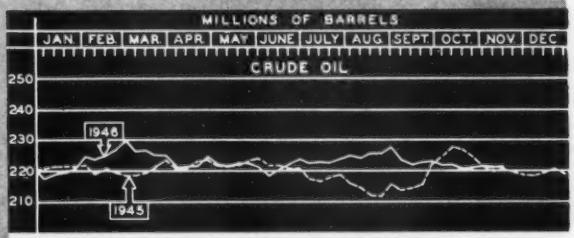
RESIDUAL FUEL-OIL STOCKS 60,065,000 bbl. as of November 23—down 547,000 bbl. One year ago 46,199,000 bbl.

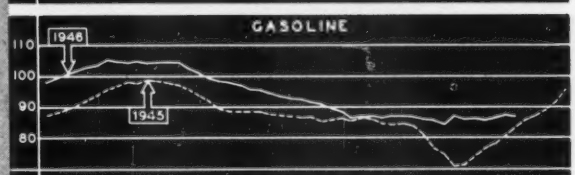
GAS OIL AND DISTILLATE STOCKS 66,543,000 bbl. as of November 23—down 678,000 bbl. One year ago 45,843,000 bbl.

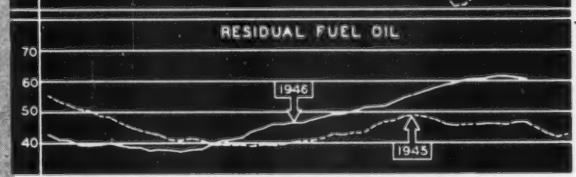
CRUDE-OIL PRODUCTION 4,809,345 bbl. as of November 30—down 7,175 bbl. One year ago 4,439,600 bbl.

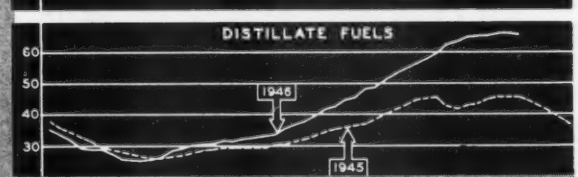
REFINERY RUNS 4,621,000 bbl. daily week ended November 23—down 95,000 bbl. One year ago 4,563,000 bbl.

OIL STOCKS IN THE UNITED STATES

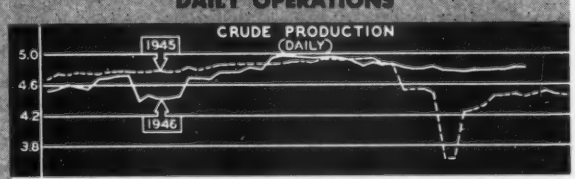


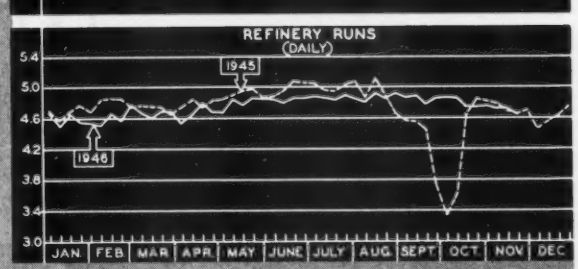




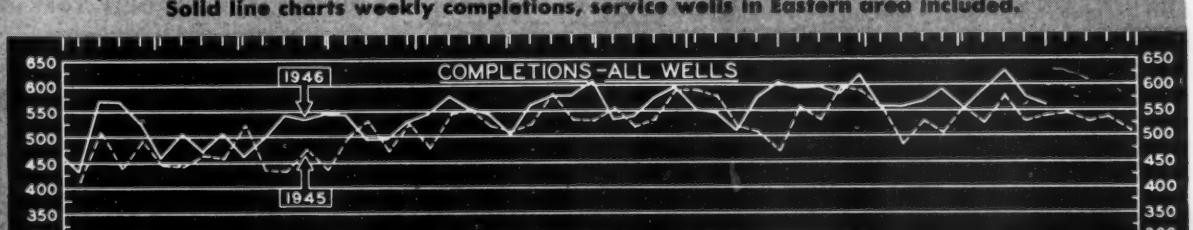


DAILY OPERATIONS

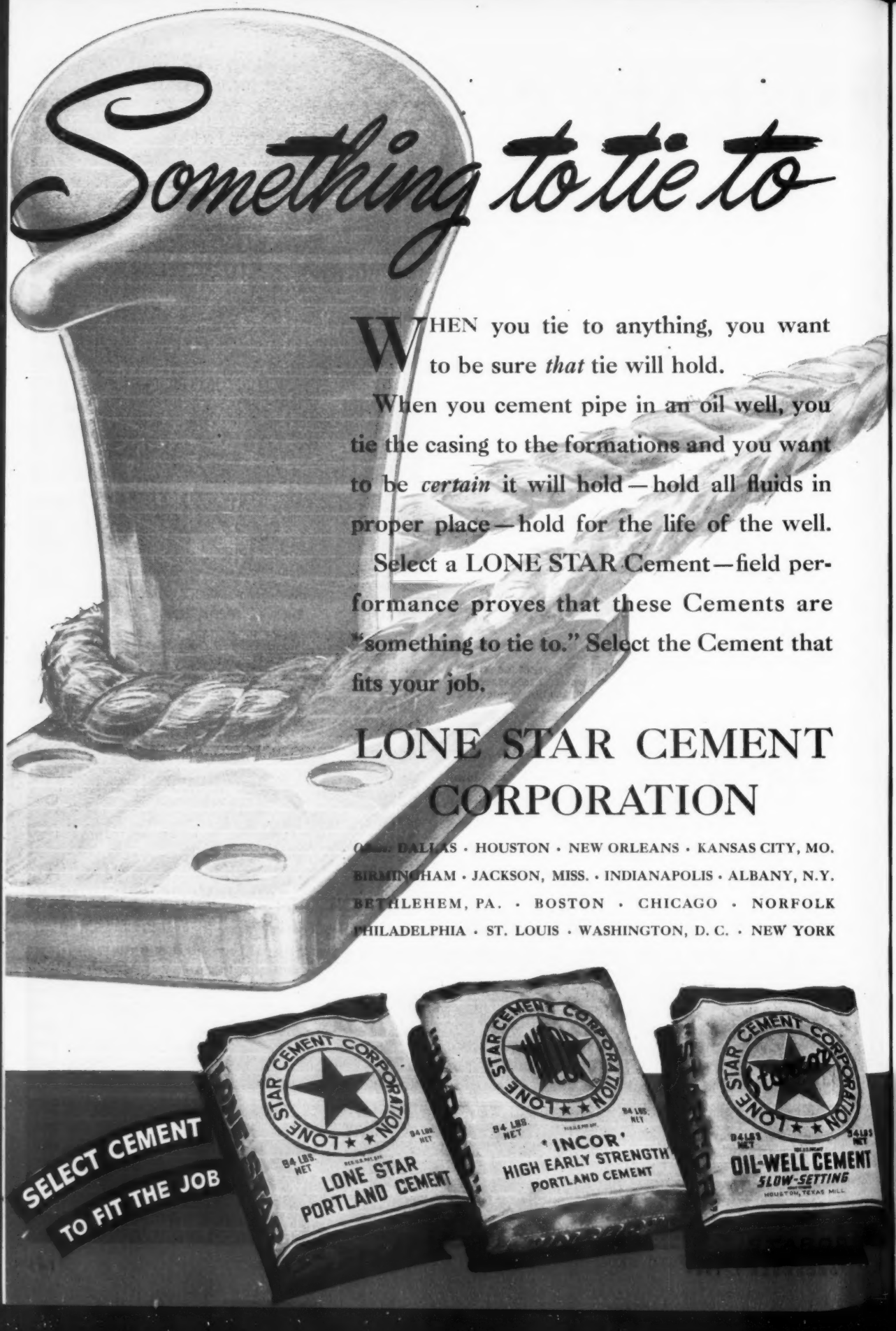




Solid line charts weekly completions, service wells in Eastern area included.



Something to tie to



WHEN you tie to anything, you want to be sure *that* tie will hold.

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HOUSTON, TEXAS MILL

Exploration and Drilling

Another Bend Arch West Flank Hit?

SUN OIL CO. 1 Jameson, in northwest Coke County, Texas, about 23 miles northwest of Robert Lee, and 1 mile southeast of Old Silver, is preparing to test a promising show in lime in the Strawn at —4,126-50 ft. With surface elevation at 2,080 ft., the Strawn lime was topped at 6,200 ft. Traces of porosity, oil stain, and fluorescence were found at 6,200-10 ft. A core of the interval 6,210-30 ft., recovered 5 ft. of lime, of which the bottom 3 ft. was very porous and saturated with oil. On a 45-minute drill-stem test at 6,206-30 ft., gas appeared at the surface in 29 minutes, and 500 ft. of 44° gravity oil was recovered.

If successful, this will be Coke County's second field. In 1942 a well in the extreme northeast corner of the county found a small amount of oil in the Cisco lime at 3,821-28 ft. and was named the Blackwell field.

The Sun test, regardless of the final outcome, will undoubtedly add to the gradual buildup of interest in a row of counties on the west flank of the Bend arch, including Coke, Sterling, Tom Green, Irion and Schleicher. Last year Shell Oil Co., Inc., opened the Tankersley field in southeast Irion County, getting oil in the Strawn at around 7,200 ft. Thus far this year, a new gas discovery has been registered in the Strawn at around 4,200 ft. in Sutton County, and oil found in a Strawn pay around 5,600 ft. in the Page field of Schleicher County.

The stratigraphic section through this row of counties, on evidence of the wells drilled to date, should hold good possibilities in the Pennsylvanian, possibly Ordovician Simpson, and of course Ellenburger. The folding, including pre-Permian, is much gentler than along the Central Basin Platform area of the basin farther west. The regional picture on the Ellenburger looks reasonably normal and simple as far as can be determined from the drilling to date. It indicates a series of nosing effects, trending northwest, as the formations dip roughly westward coming down on the west flank of the Bend arch. The counties listed cover an area that lies between the north-end complicating crossforce of the Matador (Red River) arch, and the south-end problem creating Balcones fault zone.

One of the things that has delayed more active exploration in this area is that it cannot be worked with the reflection seismograph. Now, however, with the development of the new techniques for using the old refraction-seismograph method, it is getting into the play. There is a fair amount of refraction work being done in this district at present, and the trend seems to be toward an increase in the number of crews working. Unofficial reports indicate that the Sun test is the result of such activity.

As used in this vicinity, the refractions are believed to come from the Strawn crinoidal limestone at the base of the Pennsylvanian, and possibly from the Ellenburger. If the Sun test should open up a fair field, there will be a number of wells drilled. This will afford a better check on the seismograph work and give more data on how refraction results should be interpreted in terms of the local geology.

Since the regional geology, from present indications, is not particularly complex, one moderately sized field ought to supply enough check data to permit understanding of most of the local peculiarities to be allowed for in refraction-data interpretation. Thereafter the success ratio in wildcatting might well increase rather rapidly.

EASTERN TEXAS

New Woodbine Pool For Leon County

DALLAS.—In Leon County, 4 miles southeast of Flynn, Daniel Oil Co. 1 Cox, in the J. Scritchfield Survey, reported a flow of 4 to 10 bbl. of oil an hour from perforations in the Woodbine sand at 7,036-7,428 ft. Total depth is 7,447 ft. It opens a new field. Another Woodbine test, 3 miles south of Flynn, will be drilled by M. F. Lolelinn and Rex Reid, also in the J. Critchfield Survey. Location is on the north half of the 50-acre Cole tract.

Sun Oil Co. is completing its 1 G. L. Clanton, west offset to the discovery of the Norman Paul Woodbine sand pool of Wood County, in the sub-Clarksville, giving the new area a second pay zone. Top of the sub-Clarksville at 4,796 ft. is 187 ft. high on the discovery. Elevation is 445 ft. Top of the Woodbine in the 1 Clanton was 5,284 ft., and contained no shows.

In Henderson County, Magnolia Petroleum Co.'s 2 B. W. Hearne, in the T. V. Walker Survey, was a promising extension to the Opelika field as operators cored at 8,767-79 ft., recovering 10 ft. of lime and shale with a good show of oil. Then a 1-hour drill-stem test at 8,766-79 ft., with ¼-in. chokes, recovered the 2,000-ft. water cushion cut with oil, and 200 ft. of clean oil. On last report it was drilling out below 8,818 ft.

Additional applications for drilling permits in the Waskom gas field area of Harrison County, as well as along the Marion County-Caddo Parish line, indicate continued activity there which began several weeks ago. D. Beck, Gladewater, Tex., who recently acquired acreage in the East Harrison area, is seeking permit to drill a 5,500-ft. Travis Peak or upper Rodessa series test about 2 miles west of Waskom. In Marion County, on the west flank of the Caddo field, H. W. Snowden, Dallas, is seeking permits to drill three tests on the T. Hart lease of 50 acres to 3,500-ft. depths. A. C. Gayle proposes to drill a 2,700-ft. test on the B. Harrell estate in the G. Hall Survey.

N. CENRAL TEXAS

Clay County Ellenburger Test May Produce

WICHITA FALLS.—In Clay County, Continental Oil Co. 1 Roscoe Scott, Section 3,239, TE&L Survey, 4 miles southwest of Vashti, topped Ellenburger dolomite at 6,479 ft. A drill-stem test at 6,495-6,505 ft. showed gas in 15 minutes, and at the end of 1 hour had recovered 90 ft. of oil and 210 ft. of oil-cut mud. Bottom-hole pressure was 2,050 psi. On last report it was testing at 6,492-6,515 ft., total depth. The test ran low structurally on top of the Barnett at 6,246 ft., but was figured about 120 ft. high on top of the Ellenburger at 6,479 ft, when compared to Continental's 1 Crockett, about 1½ miles to the northwest, which completed as a small producer.

Another Ellenburger test, Woodley Petroleum Co. 1-A Mabel George, 5 miles east of Baird, in Callahan County, recovered only 90 ft. of drilling fluid on drill-stem test in the Mississippian. Depth was not made known but the test was carried on to 4,157 ft. where it stopped to take another test. The section now being tested is said to show some porosity, but no shows of oil.

A new Bend conglomerate discovery in the East Henrietta pool of eastern Clay Clay County was completed last week. It is the Jack Grace 1-C Bryant Edward, in the S. C. Belden Survey. Flowing potential was 225 bbl. of 41° oil in 3 hours through 1-in. tubing choke. Casing pressure was 800 psi., and tubing pressure 225 psi. Gas-oil ratio was 5,000 cu. ft. Caddo was topped at 5,918 ft., with conglomerate pay from 6,070-6,088 ft., total depth.

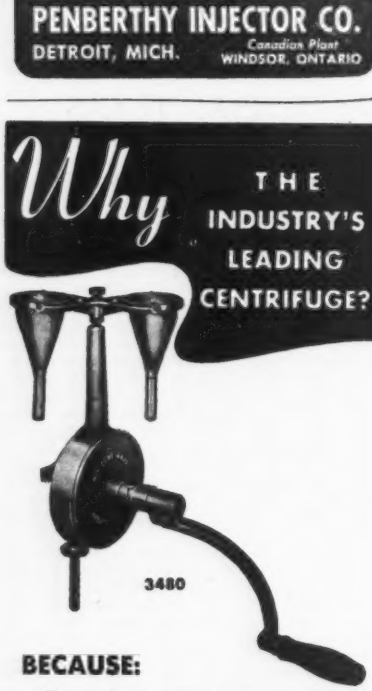
Exploration work getting under way last week included a 6,000-ft. test in Archer County, 3 miles northwest of Scotland, by

PENBERTHY
SUMP PUMPS

Used wherever seepage water accumulates, the Penberthy Automatic Electric Sump Pump and the Penberthy Automatic Drainer (water or steam operated) have demonstrated their superiority in this service. Simple and rugged design—copper and bronze construction throughout.

PENBERTHY INJECTOR CO.
DETROIT, MICH. Canadian Plant WINDSOR, ONTARIO

Why THE INDUSTRY'S LEADING CENTRIFUGE?



BECAUSE:

Heavy duty, ruggedly constructed and extremely simple in design . . . Gets quick, accurate results . . . produces required speed with less effort . . . Cranks and heads of 100 CC and 15 CC size machines interchangeable . . . Meets *A.S.T.M. Standard Method D-96* and *A.P.I. Code No. 25* requirements.

W·H·CURTIN & CO.
DEPT. "C"
HOUSTON, TEXAS . . . NEW ORLEANS, LA.

Jack Grace and Nu Enamel, which will be their 1 A. B. Edwards. In Jack County. Deep Rock Oil Corp. 1 Rebecca Ellen Thomas, in the W. L. Argo Survey, will go to 6,000 ft. In Knox County, W. J. and John J. Moran's 1 Nellie Brown was spotted in Section 177, Block 44, H&TC Survey. This test is also scheduled to go to 6,000 ft.

NORTH CENTRAL TEXAS SUCCESSFUL WILDCAT

Wilbarger County: National Associated and The Texas Co. 1 J. D. Crouch, Sec. 24, Blk. 16, H&TC Sur., 2 mi. N of Tolbert, elevation 1,342 ft., IP flowed 174 bbl. 41.7°-gravity through 14/64-in. choke, casing pressure 300 lb., tubing pressure 200 lb., GOR 172:1, perforations 5,031-58 ft. in Palo Pinto limestone, packer set 5,058 ft., TD 5,612 ft.

NORTH CENTRAL TEXAS WILDCAT FAILURES

Archer County: Wayne King 2 C. E. Carter, Clark & Plumb Subd., 3 mi. SE of Archer City, dry, TD 1,169 ft., Gunsight lime 1,126 ft., broken oil show 1,138-42 ft.

Reno Oil Co. 1 W. V. Weinzapfel, Clark & Plumb Subd., 3 mi. NW of Windthorst, dry, TD 1,968 ft. in broken sand and shale, show oil in shale at 1,243-61 ft.

Montague County: Nu Enamel 1 George E. and Roy E. Perry, L. S. Farrar Sur., 2 mi. SW of St. Jo, elevation 1,270 ft., dry, TD 7,132 ft., Caddo 6,431 ft., conglomerate and odor 6,449-59 ft.

WEST CENTRAL TEXAS WILDCAT FAILURES

Fisher County: Horne Oil Co. 1 J. W. Wheeler, George Creath Sur., 9 mi. SE of Longworth, dry, TD 4,630 ft. in shale, Dotham lime 2,545 ft., Noodle Creek 2,648 ft., Saddle Creek 2,855 ft., Flippen lime 2,908 ft.

Jones County: Jones and Stasney-Mohawk Drilling Co. 1 Hicks, 5 mi. S of Avoca, elevation 1,628 ft., dry, TD 4,970 ft., Gunsight 2,180 ft., Saddle Creek 1,935 ft., Palo Pinto 3,286 ft., sand with slight show oil 4,898-4,900 ft., Caddo 4,912 ft.

Roark, Hooker & Roark 1 F. T. Moore, Sec. 3, T&P Sur., ½ mi. NE Hodges, elevation 1,722 ft., dry, TD 2,575 ft., Gunsight lime 2,523 ft.

SOUTH LOUISIANA

New Deep Pay for Golden Meadow

NEW ORLEANS.—Barnsdall Oil Co. 1 Tamplain & Talbot, deep test in Golden Meadow field, 26-19s-22e, Lafourche Parish, gaged 4,064,000 cu. ft. of gas with 46 bbl. of condensate through a 14/64-in. choke, gas-ratio 88,400 to 1. Flowing pressure 3,700 psi. Production is through perforations at 10,010-018 ft. Total depth is 11,501 ft., and 5½-in. casing is cemented to 10,100 ft.

Barnsdall's 2 Long Bell Lumber Co., approximately ¼ mile northwest of the No. 1 test, in 1-6s-10w, Beauregard Parish, is the confirmation test for the Longville discovery area. Although production has not actually been brought in for this area. Barnsdall 1 Long Bell Lumber Co., potential discovery, recovered 20 stands of 46°-gravity oil in 20 minutes on drill-stem test at 8,228-62 ft. before a fish job developed. Operators continue to cut and pull tubing in an effort to recover the squeezing tool. At present top of the fish is at 8,081 ft. Squeeze jobs had been made from 8,263-67 ft., after which an attempt for production was to be made. Total depth is 8,430 ft. and the 7-in. casing is on the bottom.

Continental Oil Co. 7 Pardee, 17-4s-1w, 1 mile northeast extension to Reddell field of Evangeline Parish, indicated good sands showing gas and condensate from 9,935-60 ft. Total depth is 10,040 ft., where log was run and side-wall samples taken. The 6-in. pipe has been cemented to the bottom.

Thirteen field locations and 5 wildcat starts were reported this week, the wildcats being two in St. Mary, and one each in Acadia, Terrebonne and Beauregard parishes. There were 16 oil wells and 3 dry holes completed, with one dry hole being a wildcat in St. Mary Parish.

WILDCAT FAILURE IN SOUTH LOUISIANA

St. Mary Parish: Amerada Petroleum 1 South Shore, in Charenton area. 38-14s-10e, dry, TD 9,007 ft.

TEXAS GULF COAST

Three Gas Discoveries Mark Week's Testing

HOUSTON.—A new deep gas discovery for Brazoria County, McCarthy Oil & Gas Corp. 1 Marie B. Nickell, in C. Smith League, was drilled to a total depth of 12,007 ft., with 7⅝-in. casing cemented to 10,760 ft. and liner run below that point. Potential gage has not been reported.

Floyd L. Karsten 1 Reitz, wildcat 1 mile northwest of nearest production in the South El Campo field, Wharton County, flowed at the rate of 3,250,000 cu. ft. of gas daily through two ¼-in. chokes. Flowing pressure 2,200 psi. and shut-in pressure on the tubing 2,600 psi. Some condensate was reported with the gas flow, but no gage was made. The production is through perforations at 6,836-42 ft. Operators are perforating in the 5,700-ft. sand for an attempt to dual-complete in oil sands between 5,710-30 ft. Total depth is 7,200 ft., and 5½-in. casing is cemented at 6,903 ft.

Deeper production on the south flank of the Orange field of Orange County has been opened by W. V. Bowles & Co. 1 M. Granger Heirs et al. Test was reported cleaning making gas and condensate through a ⅛-in. choke from perforations at 4,725-35 ft. with 1,600 psi. pressure on the tubing and 1,700 psi. on the casing. Total depth is 5,317 ft., with 5½-in. casing at 4,780 ft., in the Hackberry formation.

Production in the South Mayes pool of Chambers County has been extended 1,400 ft. to the southwest by Humble Oil & Refining Co. 1 Lula R. Scherer, in J. Poitevent Survey. Drilled to a total depth of 9,992 ft., with perforations at 9,243-45 ft., the well flowed on initial test at the rate of 41 bbl. of 38° oil with a gas ratio of 20,920 cu. ft.

Ohio Oil Co. 6 W. D. Cornelius, on west side of production in the North Markham field of Matagorda County, I&GN Survey, flowed a potential gage of 205 bbl. of 36° oil in 24 hours through a ⅛-in. choke, 1,565 psi. flowing pressure on the tubing and 2,650 psi. on the casing. Total depth is 8,522 ft. with perforations at 6,966-70 ft.

Pan American Production Co. 4 Olive Sternenberg Lumber Co. in the J. Landis Survey, extended the Olive pool of Hardin County to the northeast. On a 6-hour test the well flowed at the rate of 230 bbl. daily through an 11/64-in. choke with 2,150 psi. tubing pressure. Production liner is cemented at 10,005 ft. and the drilled-out total depth is 10,096 ft. Two new extension tests have been reported by Pan American, each projected to 10,500 ft. The 5 Olive Sternenberg Lumber Co. is in the Greenberry Dorsey Survey, 6,529 ft. northwest of the nearest production, and the 6 Olive Sternenberg Lumber Co. in the Joel Lewis Survey, being 2,568 ft. southeast of the No. 3 southwest extension producer.

There were nine new locations reported this week, two being wildcats, one each

in Jefferson and Washington counties. The 18 completions included 1 discovery in Chambers County and 1 dry hole in Brazoria County. Harris and Matagorda counties each received four completions, Brazoria two, Chambers, Colorado, Galveston, Jackson,, Jefferson, Liberty, Polk and Wharton counties 1 each.

UPPER GULF COAST SUCCESSFUL WILDCAT

Chambers County: New condensate pool—Standard Oil Co. of Texas 1 State-Galveston Bay, Lease 27,129, in Galveston Bay, Section 201, 1 mi. NE of Red Fish Reef production, TD 11,390 ft., top sand 8,752 ft., perforations 8,752-66 ft., PT 288 bbl. per day through a ¼-in. choke, ratio 11,490 to 1, TP 2,250 lb., gravity 53°, no water.

UPPER GULF COAST WILDCAT FAILURE

Brazoria County: McCarthy Oil & Gas Corp. 1 T. L. Smith, Jr. et al, in J. H. Bell 1½ League, 1 mi. SE of West Columbia, dry, TD 10,870 ft.

PERMIAN BASIN

New Permian Pool For Andrews County

MIDLAND.—A new oil area for northern Andrews County was assured last week at Fred Turner, Jr. 1 Fisher, in Section 16, Block A-36, and approximately 4 miles west of the Means field. While production tests were awaiting pumping equipment, it was estimated good for 250 bbl. of oil a day from San Andres limestone. The test was drilled to 4,500 ft., where it encountered sulfur water, then plugged back to 4,456 ft. and swabbed at the rate of about 10 bbl. of oil an hour, some 1,500 ft. off bottom. Turner has skidded the rig 1,320 ft. south for a second test, which will be the 2 Fisher. The new area is 7 miles northwest of the town of Andrews.

Humble Oil & Refining Co. 2 H. O. Sims test in Andrews County, Section 25, Block A-39, PSL Survey, took a drill-stem test in the Ellenburger at 10,492-535 ft. Open 85 minutes, it recovered the 1,450-ft. water cushion plus 3,250 ft. of clean 42° oil. Estimated recovery was at the rate of 36 bbl. of oil an hour, with a flowing pressure that built up from 1,100 psi. to 2,000 psi. through ¾-in. choke. Casing is to be run before completion tests are made.

Sun Oil Co.'s Coke County wildcat, 23 miles northwest of Robert Lee, the 1 A. Jameson, swabbed down to 6,230 ft., total depth, recovering 90 per cent oil. Swabbing was into pits and no estimate was made on the amount of oil recovered. Shut in overnight, fluid rose to within 200 ft. of the surface. Operators attempted a drill-stem test at 6,225-30 ft. but failed to get the tool open. This prospective discovery is in the Crinoidal section of the Pennsylvanian.

In southeast Reeves County, Argo Oil Corp.'s 1 Roberts was said to have flowed at the rate of 55 bbl. of oil a day. Reports are that it builds up to around 2,250 psi. when shut in, flows about 55 bbl. of oil, then dies. Operators were to acidize at 9,895-10,875 ft.

Wildcat reports on West Texas tests included: Andrews County, Olson Drilling Co. and Skelly Oil Co. 1-A Lockhart & Brown, Section 21, PSL Survey, drilling ahead below 8,035 ft. in lime and chert; Globe Oil & Refining Co. 1 Lockhart & Brown, Section 20, washing perforations at 6,850-6,900 ft. and 6,915-49 ft. with mud acid, before using regular acid, after swabbing a slight show of oil at that level; Placid Oil Co. 2 Thornberry, Section 3, 2 miles west of the Fuhrman field, took a drill-stem test at 10,142-284 ft., and in 1 hour recovered 350 ft. of oil and gas-cut mud. In Ector County, Gulf Oil Corp. 1-A

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University-Fogelson, deep test in the Jordan field, ran a drill-stem test at 6,568-6,618 ft., which recovered 360 ft. of oil and gas-cut mud, plus 6,000 ft. of sulfur water. On last report it was drilling ahead below 6,618 ft. in dolomite. Gulf's 421-E Goldsmith, deep test in the Goldsmith field, was drilling below 5,225 ft. in limestone.

In spite of the shortage of drill pipe and casing, new work is holding up. A total of 38 locations were reported last week, with Hockley County getting 8, Winkler 6, Andrews 5, and Garza County 4. The balance were scattered throughout the basin area.

WEST TEXAS SUCCESSFUL WILDCAT

Runnels County: Geochemical Surveys 1-A J. W. Harris, J. V. Cabrera Sur., ½ mi. W of Crews, flowed 59 bbl. 42°-gravity oil per day through ¼-in. tubing choke, from Gardner sand at 3,904-19 ft., casing pressure 90 psi.

WEST TEXAS WILDCAT FAILURES

Andrews County: Marr & Vaughn 1-26 Lotus Oil Co., Sec. 26, PSL Sur., 2 mi. SW of Fullerton field, dry, TD 226 ft.

Fisher County: Horne Oil Co. 1 J. W. Wheeler, Geo. Croach Sur., 3 mi. N of Eskota, elevation 1,875 ft., dry, TD 4,631 ft. in lime, Noodle Creek 2,643 ft., Saddle Creek 2,855 ft., coal 2,906 ft., Flippen 2,908 ft., good stani 2,880-90 ft.

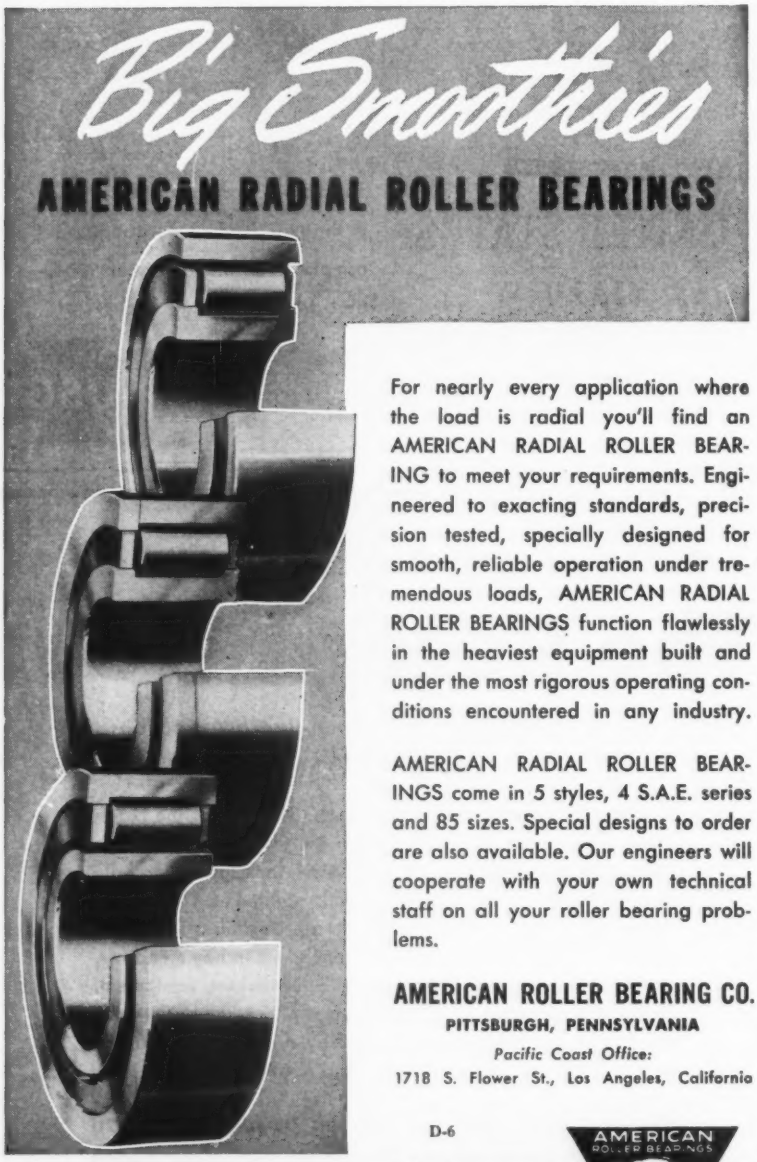
Pecos County: Peck, Penn & Richardson 1 W. R. Tyler, Sec. 12, H&GN Sur., 4 mi. W and S of Imperial, elevation 2,412 ft., dry, TD 2,640 ft., Yates 1,410 ft., show of oil 1,400 ft.

Winkler County: M. J. Delaney Co. 1 Sealy Smith, Sec. 16, G&MMB&A Sur., 2 mi. NE Monohans pool, dry, elevation 2,792 ft., TD 5,952 ft., Yates 2,600 ft., San Andres 4,020 ft., Glorietta 5,220 ft.

SOUTHEASTERN NEW MEXICO

HOBBS.—Sun Oil Co. 1-B McKinley, Section 20-18s-38e, an old well deepened to the lower Permian, swabbed down to 7,000 ft. and reported a total of slightly less than 25 bbl. of fluid with some oil. The swab was down for repairs, after which it will clean out to test. Total depth is 7,656 ft. Location is between the Hobbs and Lovington fields in Lea County. Seven miles east of the town of Lovington and 8 miles northeast of the field, Skelly Oil Co.'s 1 Yadon, 11-16s-37e, had found no signs of commercial production to total depth of 5,410 ft.

Skelly's 5-B Baker, 10-22-37e, north offset to Ellenburger production on the southeast side of the Brunson field, was testing through perforations at 6,488-6,510 ft., believed to be in the Yesso, below the San Andres, after treating with 500 gal. of acid. It was barren in the Ellenburger, and found the basement complex at 7,312 ft., or —3,895 ft. It was plugged back to 6,550 ft. to set casing at that depth.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SOUTHWEST TEXAS

New Oil Pool for San Patricio County

CORPUS CHRISTI.—Hewit & Dougherty 1 Lois Thornton, a new wildcat discovery well in San Patricio County, approximately 2 miles northwest of San Patricio townsite, flowed on 24-hour potential gage 28 bbl. of oil per day through a 5/32-in. choke, with 160 psi. tubing pressure and 420 psi. on casing. Gas sand was topped at 5,362 ft., cored oil and gas sand, and shale streaks down to 5,440 ft., and logged oil sand at 5,440-56 ft. Total depth is 5,869 ft., with the 5½-in. casing set at 5,501 ft. Production is through perforations at 5,442-56 ft. This new producer is in John McMullen Survey.

Oil production at LaReforma field in Starr County has been extended 1 mile southward by Baldridge & King. Their 1-B A. Guerra recovered 350 ft. of clean oil on a 15-minute drill-stem test at 6,048-56 ft. under 68 lb. of pressure, using ¼-in. chokes. Operators are coring ahead from 6,086 ft.

Sun Oil Co. 1-A C. M. Hall, in CCSD&RGNG Survey 271, ⅝ mile south of Sun field in Starr County, flowed ½ bbl. oil per hour on initial test through perforations at 4,714-28 ft. This well was drilled to a depth of 10,542 ft. before plugging back for completion test. Operators are installing flow valves and will complete on gas-lift through perforations at 4,714-28 ft.

Daubert & Achning 1 M. Villareal, wildcat test in the "Santa Cruz" grant about 1¼ miles southeast of the Kelsey field in Starr County, recovered 1,100 ft. of oil in 20 minutes, on drill-stem test at 5,926-36 ft., with 156 psi. working pressure. Operators are coring ahead below 5,936 ft.

In the area north of the old North Lucas field, in southeastern Live Oak County, L. M. Lockhart 1 Ross Booth, tested through perforations at 5,234-60 ft., and flowed 40 stands of 41°-gravity oil. Located in the Maria Bridge Kivlin grant 11, 2 miles southeast of Dinero, this test was drilled to 5,550 ft., with 5½-in. casing set to 5,500 ft.

Sun Oil 1 Emil Els, located 5,700 ft. southwest of nearest oil production at Boyce field, in Goliad County, tested gas and condensate in the Pettus sand on a 12-minute drill-stem test at 4,193-4,203 ft. Operators are drilling ahead below 6,998 ft. The regular pay at Boyce field is in the Luling sand at 7,600 ft.

A new gas pool has been opened by Hickok & Reynolds et al 8-C J. F. Welder Heirs, approximately 1 mile west of Seven

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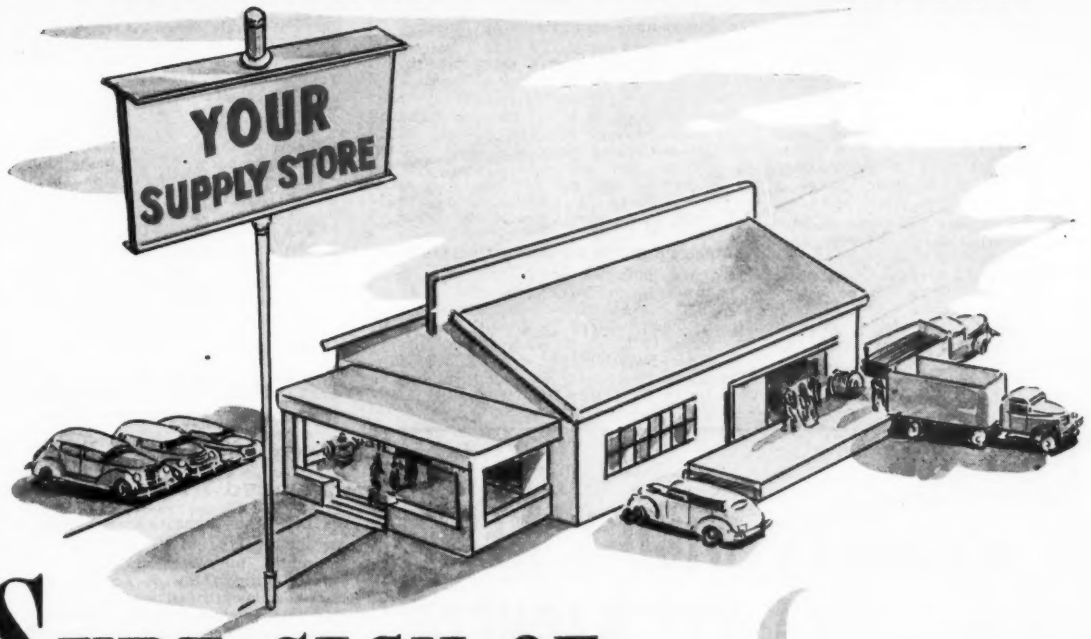

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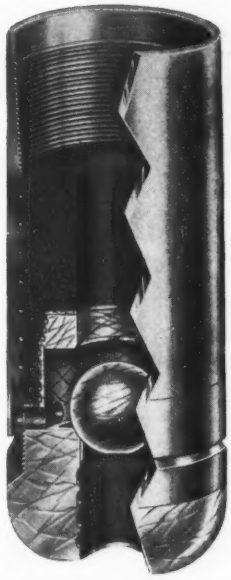

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Sisters field in Duval County. Operators are waiting on potential test through perforations at 2,525-27 ft. in Loma Novia sand.

The name "Landa" has been given to the field discovered by Stanolind 1 Harry Landa, in the A. del Gato grant, about 6 miles southwest of Donna, in extreme south edge of Hidalgo County. The name "East Charco Redondo" has been given the field discovered by F. P. Schwab 1-A A. Garcia in Charco Redondo grant, in Zapata County.

Eleven of the 44 new locations reported this week are wildcats, 3 in Bee, 2 in McMullen, and 1 each in Guadalupe, Duval, Jim Wells, Live Oak, Refugio, and Zapata counties. Duval and Refugio counties received the greatest number of new starts with five each. There were 40 completions, 23 oil and 9 dry. There were nine wildcat completions, one discovery in Kleberg County, and eight dry holes, one each in Atascosa, Bee, Duval, Victoria, Webb, Williamson, Zapata and Zavala counties. Duval, Karnes, and Refugio counties led in completions each receiving four.

SOUTHWEST TEXAS SUCCESSFUL WILDCAT

Kleberg County: New gas-condensate pool Sun Oil Co. 4 E. G. Canales, CCSD&RGNG Survey 339, 1⅘ mi. SE of Tijernia-Canales field, TD 10,554 ft., PT 130 bbl. per day of condensate and 5,840,000 cu. ft. gas per day through a ¼-in. choke, TP 4,800 lb., shut-in pressure 7,600 lb., 9.15 bbl. water per day.

SOUTHWEST TEXAS WILDCAT FAILURES

Atascosa County: Harris S. Stahl 1 Suzanna Pratt, ½ mi. SW of Rossville, in F. de la Garza Survey 46, dry, TD 2,407 ft.

Bee County: Dirks Bros. 1-C Laura M. Rapp et al, in T. B. Brashear Survey, 5 mi. SW of Pettus, dry, TD 3,695 ft.

Duval County: John F. Camp & Sons 1 James F. Welder Hrs., in Samuel Alexander Survey 102, 9 mi. NE of Freer, dry, TD 3,130 ft.

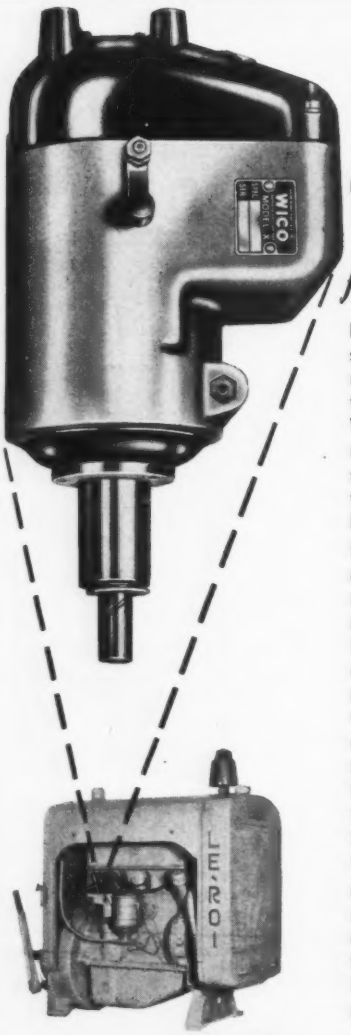
Victoria County: Sterling O. & G. Co. 2-A J. J. Welder, in I.R.R. Co. Survey 9, 6 mi. SE of Nursery, dry, TD 6,032 ft.

Webb County: Interstate Minerals, Inc. 66 R. Lopez, in Survey 309, in Glen area, 12 mi. S of Mirando City, dry, TD 1,825 ft.

Williamson County: J. O. Fox et al 1 Annie and Arthur Kerlin, in Pedro Zara Survey, 4 mi. N of Thrall, dry, TD 1,730 ft.

Zapata County: Government Wells Oil Co. 2 Juana Garza de Uribe, TCRR Survey 249, 25 mi. S of Mirando City, dry, TD 1,419 ft.

Zavala County: David S. King 1 Chas. D. Matthews, I&GN Survey, 4½ mi. W of La Pryor, dry, TD 2,360 ft.



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Steveville-Princess Field Extended 7 Miles Southward

CHATHAM.—Indicating a potential producing area in the Madison limestone extending for 7 miles, South Princess Joint Venture C.P.R. 3, LSD 12, 8-19-11w4, has been confirmed as the largest producer in the new south extension of the Steveville-Princess field in southern Alberta. Finished in the limestone at 3,326 ft., the well had flows of 27.3°-gravity crude ranging from 121 bbl. with 9/64-in. choke to 198 bbl. with 12/64-in., in all cases producing against strong back pressure. Gas-oil ratio has been reduced to 848 to 1. The well was closed in after filling all available storage. The three successful tests in the south extension were drilled by a group including Pacific Petroleums, Empire Petroleums, Globe Oil, Homestead Oil & Gas, Pacalta Oills, Phillips Petroleums (Calgary) and California-Standard, with the latter handling the drilling. Joint Venture 4 is being located.

Turner Valley.—In the Turner Valley north extension, Home Millarville 23, LSD 7, 5-21-3w5, after prolonged testing of the Madison lime at 8,350-8,880 ft. is rated around 200 bbl. The test was an outpost well west of production. In North Turner Valley, Home-Millarville 22, LSD 6, 32-20-3w5, with Madison at 8,434-8,696 ft., is making 200 bbl. on compressor.

Northern Foothills.—Imperial Oil has taken up two extensive reservations of 173,812 and 192,640 acres in a new area of the northern foothills 40 miles due west of Edmonton. The acreage extends south from Mayerthorpe to Moon Lake and lies on both sides of the C.N.R. main Edmonton-Prince Rupert line.

Little Smokey River.—A reservation of approximately 200,000 acres on the Little Smoky River in northern Alberta is to be jointly tested by a group comprising McColl-Frontenac Oil Co., Socony-Vacuum, Imperial Oil, Shell Oil and Gulf Exploration. Following seismic surveys completed last year, a 70-mile road has been built to reach the prospective drilling area. Drilling will start early next year. The area is about 100 miles north of Jasper, Alberta.

Elk Point.—In the northern Alberta salt area, Elk Point 3, LSD 15, 35-57-5w4, has completed drilling at 5,007 ft. through an extensive salt bed, and has run casing to test overlying gas production from the lower Cretaceous just below 1,700 ft. The well is one of a series of joint tests sponsored by Anglo-Canadian, Home Oil and Calgary & Edmonton Corp.

Del Bonita.—In the Del Bonita area, southern Alberta, McLeod-Del Bonita 1, LSD 13, 14-1-21w4, has halted drilling with Madison lime at 4,915-65 ft. and will test oil and gas saturation in the upper horizon before deepening to the lower porous.

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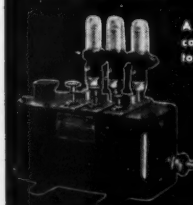

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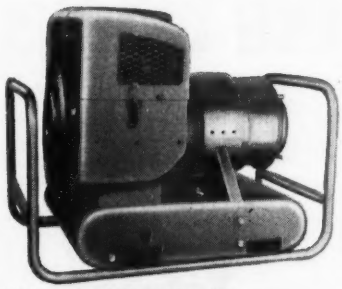
Onan pioneered this modern, single-unit construction in the field of independent electric plants. All Onan portable engine-generators are direct connected for positive permanent alignment and ultimate compactness.

There is an Onan model for every portable, mobile, stationary and standby job requiring heavy-duty electric service. Lightweight, easy-to-carry, air-cooled plants (350 to 5,000 watts); streamlined, mobile-or-stationary water-cooled plants powered by 4 and 6 cylinder industrial engines (5,000 to 35,000 watts).

BUILT FOR THE OIL FIELDS!



Model 5CK-115M. Lightweight construction. 5,000-watt, 115-volt D.C. Manual starting, 2-cylinder air-cooled engine.

Many Onan models are specially designed and equipped for the oilfields, where the going is always tough. These rugged units provide dependable, low-cost electric power for geophysical survey, well-servicing, lease-house lighting, and drilling rigs.

Onan Electric Plants are available in many sizes and models. ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies. DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts. BATTERY CHARGERS: 500 to 3,500 watts; 6, 12, 24 and 32 volts.

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WECO "Speed Thread" Wing Unions offer the safest, fastest, and longest lasting means of handling pressures on any line. It is unaffected by vibration . . . rough treatment. The spherical line seat forms a perfect seal regardless of wear. They have been proved in service through the years. They make up fast. They hold safely. They break out easily due to WECO'S original design, accurate threads, positive seal.

Use WECO "Speed Thread" Wing Unions on mud lines, steam lines . . . any place around the rig. WECO "Speed Thread" Unions are one leading member of the most complete line of wing unions in the world in sizes from 1" - 10", pressures 1000 - 12,000 lbs. test . . . designed for safer service, longer life. Buy the ORIGINAL Wing Union. Buy the best . . . Buy WECO.

- No wrench necessary to assemble—dismantle.
- Forged Steel
- Acme Threads mean speed . . self-locking.
- All parts interchangeable
- Knurled for safety and speed.

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field in the Alberta foothills west of Calgary, Shell 16-14-J, LSD 16, 14-25-5w5, has been definitely completed with 1,193,000 cu. ft. open flow from the Madison limestone at 10,335-10,578 ft. There is a small naphtha recovery. This is the second producer in three deep tests drilled by Shell. Shell 5-7-1, LSD 5, 7-25-4w5, is starting work about a mile east and south of 16-14-J, and about 2 miles south of the discovery well.

APPALACHIAN FIELD

Location Staked for Outpost To Large Fayette Co. Gasser

PITTSBURGH. — On Chestnut Ridge in Springhill Township, Fayette County, southwest Pennsylvania, Manufacturers Light & Heat Co. has staked a location for a test on George Steve farm, approximately 1 mile southwest of the large gas well on the Smith farm. This well is now feeding 12,000,000 cu. ft. gas a day in the line holding a back pressure of 420 lb. Since turned in the line the last of September it has produced over 700,000,000 cu. ft. gas which is a near record for the east.

In Bell Township, Clearfield County, F. C. Deemer is drilling at 7,540 ft. in the important wildcat on Alice Irvin farm and still in lime. The Onondaga was topped at 7,424 ft. and is unusually thick.

New locations for the past 2 weeks total 18, and are located in Allegheny, Armstrong, Greene, Indiana, Washington, and Westmoreland counties.

In Simpson district, Harrison County, West Virginia, Hope Natural Gas Co. completed 2 large Fifty Foot sand gas wells. The No. 9,080 M. O. Goff gaged 4,270,000 cu. ft. gas, total depth 1,636 ft., and the No. 9,081 Lutie E. Williams, 6,039,000 cu. ft., total depth 2,017 ft.

Interest is revived in Braxton County where in Otter district, Braxton County Gas Co. completed a test B. G. Howell good for 1,050,000 cu. ft. gas from the Big Lime, total depth 2,021 ft.

In Portland district, Preston County, Manufacturers Light & Heat Co. have completed the new line from its main line to the good wildcat completion of Wm. E. Snee and Orville Eberly et al on the Harrison Sisler farm. Gas has not yet been turned in the line to test the 4,000,000 cu. ft. Onondaga chert gas completion but as soon as regulators have been checked along the line, the test will begin.

MICHIGAN

Wildcatters Have Successful Week

SAGINAW.—Marked by 3 wildcat producers, 1 oil, and 2 gas, Michigan operators chalked up a much better than usual week with 18 completions, 7 oil wells, 6 gas wells and 5 dry holes. Ten new locations were announced.

The wildcat oil producer A. J. Boeve 1 Alphen, SE NE SE 35-5n-1w, in Jamestown Township, Ottawa Township, pumped and flowed 175 bbl. a day after acid treatment. The new gas discoveries are in Howell Township, Livingston County, where Panhandle Eastern Pipeline Co. reported initial of 6,400,000 cu. ft. a day from 1 McPherson at 3,907 ft., and in Morton-Mecosta where Michigan Consolidated Gas Co. 1 Stickler rated 1,663,000 cu. ft.

Initial potential from the seven oil wells was 3,190 bbl., 4 of them being completions in prolific Arenac County, one testing 1,200 bbl. in Deep River, another 1,440

High in Work Capacity *Low* in Operating Cost

High work capacity, combined with low operating costs have made Chrysler Industrial Engines the first choice of many manufacturers in the field of powered industrial equipment.

Their high compression, flexible horsepower and low weight characteristics permit installation in a minimum of space. Superfinishing of moving parts brings economical operation plus maximum time *on the job.*

Chrysler Industrial Engines in your equipment, plus nation-wide parts availability, mean more satisfied customers and repeat business. Send the coupon today for the Industrial Engine catalog.

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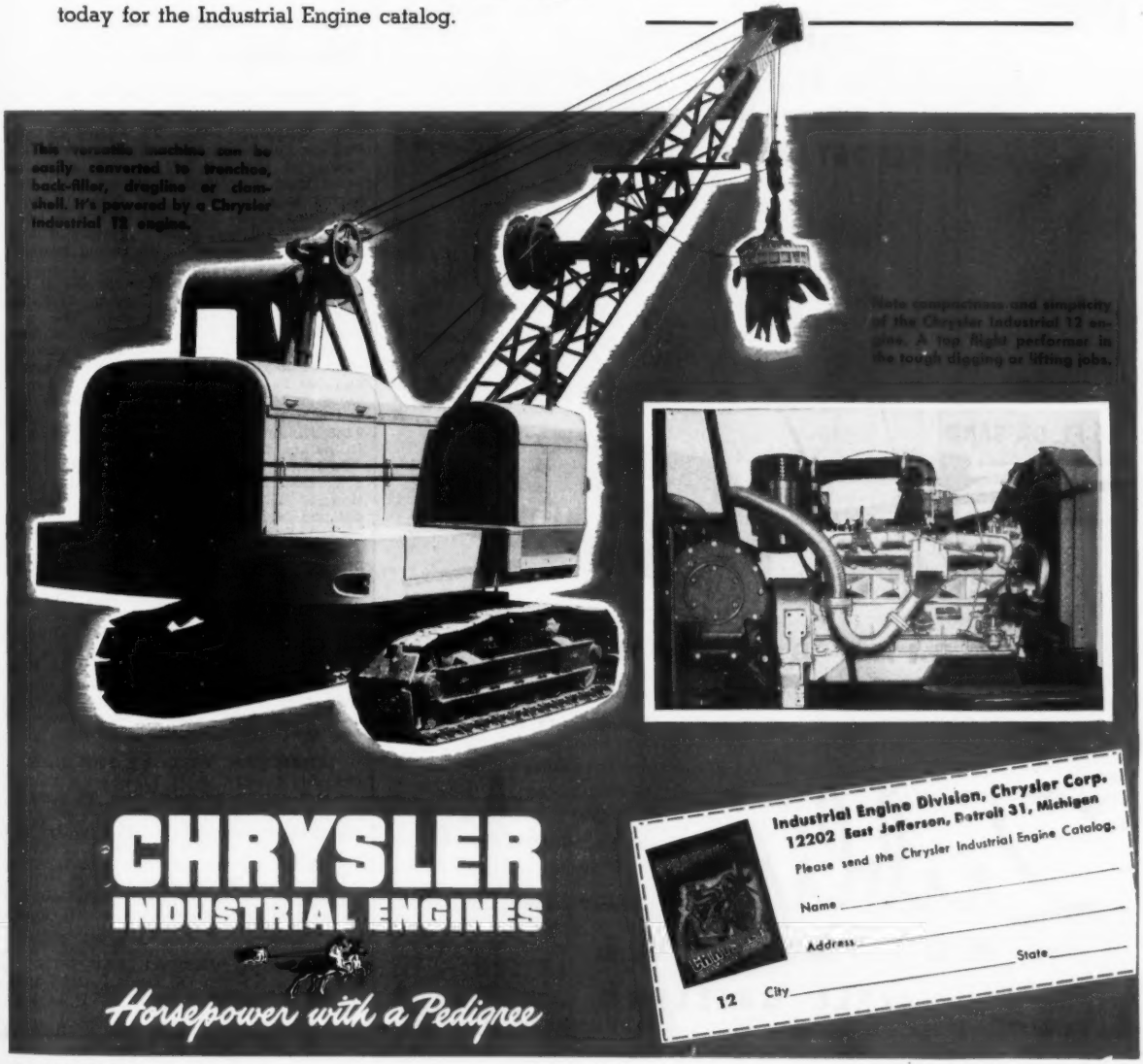
Crane Loaders	Portable Well Drillers
Farm Tractors	Road Rollers
Fire Pumps	Self-propelled Farm Combines
Fuel Oil Pumps	Soil Pulverizers
Gang Mowers	Street Flushers
Generator Sets	Winches


This versatile machine can be easily converted to trenchoe, back-filler, dragline or clam-shell. It's powered by a Chrysler Industrial 72 engine.
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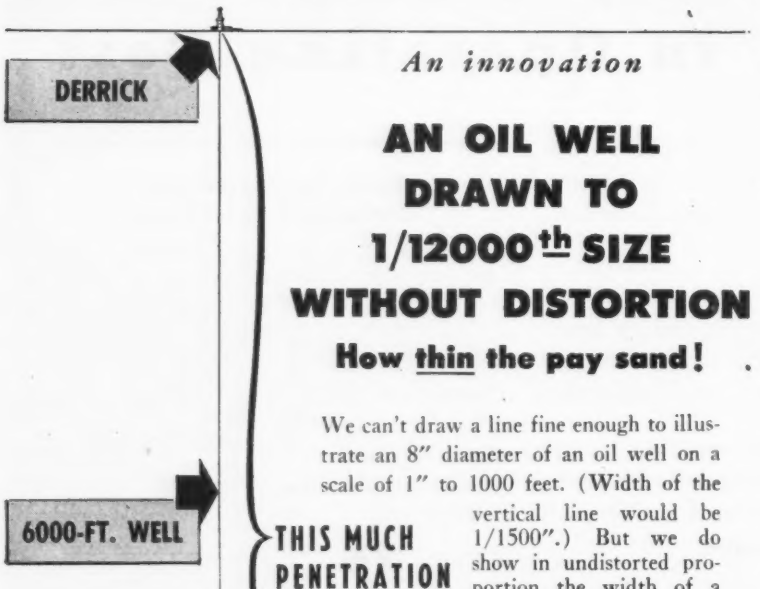
IT'S THE FOOTAGE OF HOLE IN THE OIL SAND THAT COUNTS



An innovation

AN OIL WELL DRAWN TO 1/12000th SIZE WITHOUT DISTORTION

How thin the pay sand!

We can't draw a line fine enough to illustrate an 8" diameter of an oil well on a scale of 1" to 1000 feet. (Width of the vertical line would be 1/1500".) But we do show in undistorted proportion the width of a 60-foot oil sand in relation to 6000 feet of hole. The sand is only 1% of the well's depth.

Don't you think this 60 feet of pay sand should be tapped horizontally with drain holes? After all, it's the footage of hole in the oil sand that counts.

Horizontal drilling WILL increase your production.

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Zublin

HORIZONTAL WELL DRILLING

in the same area. Of the 10 new locations, 4 are in Allegan County, 2 in Osceola County, 1 each in Arenac, Kent, Tuscola and Van Buren.

MICHIGAN SUCCESSFUL WILDCATS

Livingston County, Howell Township: Panhandle Eastern Pipeline Co. 1 M. J. McPherson Estate, NW SW SE 35-3n-43; gas well; 6,400,000 cu. ft.; TD 3,907 ft.

Mecosta County, Morton Township: Michigan Consolidated Gas Co. 1 Frank S. Stickler, C-SW 15-14n-8w; gas well, 1,663,000 cu. ft.; TD 1,292 ft.

Ottawa County, Jamestown Township: Arthur J. Boeve 1 Tillie Alphen, SE NE SE 35-5n-1w; pump and flow 175 bbl. with salt water, acidized; TD 1,654 ft. in Traverse limestone.

MICHIGAN WILDCAT FAILURES

Gladwin County, Grout Township: C. E. Weller 1 J. A. Bessler, SW SW SE 12-18n-2w; dry in Dundee; TD 3,881 ft.

Kent County, Solon Township: Rex Oil & Gas Co. 1 Ora J. Beals, NE NW SE 34-10n-11w; dry in Traverse limestone; TD 2,420 ft.

Saginaw County, Albee Township: Fred W. Craft 1 A. & A. E. Willie, C-N½ NW SE 29-10n-4e; dry in Dundee; TD 2,925 ft.

MISSISSIPPI

Adams County Discovery Preparing to Swab

JACKSON.—Wildcat operations were active over the past week, with a number near completion stage. In Adams County, Phillips Petroleum Co. 1 Artman, 36-8n-2w, flowed at the rate of 5½ bbl. of oil an hour, then died, and operators were preparing to swab. Flow was through 12/64-in. tubing choke from perforations at 5,618-22 ft. The oil was of 37.7° gravity; tubing pressure was 200 psi., with casing pressure of 445 psi.

In Jefferson County, Humble Oil & Refining Co.'s 1-B J. F. Gordon, 44-9n-1w, was drilling at 11,110 ft. in shale. The same interests' 2 J. F. Gordon, in 31-9n-1w, took a drill-stem test at 9,700-13 ft. which recovered 30 ft. of mud, 390 ft. of salt water, and 540 ft. of salt water-cut mud. A previous test at 9,680-91 ft. recovered oil and salt water. Cement plug was run at 9,600-9,800 ft. and operators set casing at 3,737 ft. before further testing.

In Lincoln County, Crescent Drilling Co.'s 1 Vernon, 31-8n-7e, found oil and saturation at 10,475-478 ft. but a fishing job delayed testing. In Section 16-8n-5e, Humble's 1 Board of Supervisors recovered 1 ft. of hard shale, with no shows, at 10,213-216 ft., and was drilling ahead below 10,438 ft., still in the shale.

A new producing sand for the East Heidelberg field of Jasper County was reported last week at the Douglas Whitaker 1 Waldrup, 13-1n-12e, on the northern side of the field. The test was said to have been drilled near the fault plane of the field, cutting the fault below the Morrison sand and picking up the Stanley sands. The new sand was found at 5,062-75 ft.

MISSISSIPPI WILDCAT FAILURES

Grenada County: J. R. Lockhart 1 Lamon, N/2 SW SW 22-22n-6e, dry, TD 2,762 ft., no tops reported.

Issaquena County: C. H. Murphy, Jr., and Sun Oil Co. 1 J. Atkinson, E/2 NW SE SW 4-9n-8w, dry, TD 4,005 ft., Cook Mountain 838 ft., Sparta 973 ft., Wilcox 2,094 ft., Midway 3,318 ft., conglomerate 3,720 ft., Gas Rock 3,737 ft., Tuscaloosa 3,747 ft., Paluxy 3,881 ft.

FLORIDA WILDCAT FAILURES

Dixie County: Sun Oil Co. 1 Hazel Langston, NW SE 8-8s-14e, dry, TD 3,671 ft., no tops reported.

Flagler County: Humble Oil & Refining

Co. 1 Lake Crescent Farm Co., Inc., NW NE 8-11s-28e, dry, TD 1,822 ft., no tops reported.

ROCKY MOUNTAIN

Baggs Dome Prospect Looks Better in Lower Sands

DENVER. — Indications favorable for a discovery in Kerr-McGee-Phillips Petroleum Co. 1 Unit, SE SE 10-12n-92w, South Baggs dome, Carbon County, Wyoming, improved with deeper drilling. The hole was deepened to 3,781 ft., at which depth a drill-stem test was made at 3,771-81 ft. With tools open only 24 minutes it showed for more than 3,474,000 cu. ft. of gas plus 50 ft. of oil, but no water. The volume of gas was larger than the maximum capacity of the gage. Another test at 3,781-90 ft., open 4 hours, had a recovery of 1,200,000 cu. ft. of gas and some oil through a 5/16-in. choke. The last test was unsatisfactory, having taken place in very cold weather at midnight, with the packer failing several times while it was in progress. The last two tests are believed to have been in the Fort Union formation where better sand conditions usually are found than in the Tertiary Wasatch above.

Gas in Utah wildcat.—Carter Oil Co. 1 Davis, NW NW 33-4s-20e, a wildcat on the West Vernal structure, Uintah County, Utah, in the Uintah Basin, which was reported last week to have topped a gas sand at 5,856 ft., drilled to 5,932 ft., and is testing. A drill-stem test at 5,832-70 ft., open 1½ hours, recovered 3,000,000 cu. ft. of sweet dry gas, estimated. The shut-in pressure was 1,700 psi. The formation is not identified, but probably it is in or near the top of the Upper Jurassic. The location is 50 miles northwest of the Rangely field where the Weber in the Pennsylvanian is the producting horizon, and which may be explored in this well. The structure is a large one with 57,504 acres in the unit.

Rangely outpost.—Continental Oil Co. 4 Dorothy Rooth, NW NW 22-2n-103w, a key well on the west side of the Rangely field, and a south offset to the discovery in the Shinarump, topped the Weber at 6,915 ft., 1,142 ft. below sea level, and drilled to 6,935 ft. (—1,175). A drill-stem test at 6,917-55 ft., open 4 hours, recovered 260 ft. of oil and 270 ft. of mud, but no water. The bottom, however, is only a few feet off the water level. Casing is being run.

Pure well at River Dome.—Pure Oil Co. 3 Unit, SW SW 17-48-92w, River Dome, Washakie County, Wyoming, 1 mile southeast of the discovery in the Embar, which flowed 28 bbl. per day natural at 10,151 ft., has improved considerably as a result of heavy acidization. It flowed 314 bbl. in 23 hours. After reacidizing, it flowed 586 bbl. in 24 hours through ¼-in. choke, with 4,400,000 cu. ft. of gas. Flowing tubing pressure on a short test was 2,300 psi. It is still testing.

Bowdoin lease sale.—Largest lease sale of federal land on a single structure took place November 21 when bids were received on 20,127 acres in 52 parcels on the Bowdoin dome, Phillips and Valley counties, Montana. More than 500,000 acres are under lease on and around the structure, extending over into Canada. Texas Co. is drilling the first of three tests to explore as many separate areas of the enormous field in 1 Unit, SW SW 8-32n-32e, which set the 9⅝-in. at 3,195 ft. Top of the Madison was at 3,201 ft.

Deep test southwestern Colorado.—Barker Dome Oil & Gas Co. which has been organized to take over the operation of the gas field of that name in northwestern New Mexico and southwestern Colorado, is moving in heavy rotary to drill to the gas horizon in the lower Pennsylvanian at around 10,000 ft. in 18 Barker Creek, SW SW SW 11-32n-14w, Montezuma County, Colorado. It is a subsidiary of Southern Union. The location is on a tract of 4,000 acres in the Southern Ute Indian Reservation which Delhi Oil Corp. of Dallas, a subsidiary of Southern Union, bid in last month for $162,005. Four deep wells have been drilled on the New Mexico side ranging from 30,000,000 to 60,000,000 cu. ft. each. New operation is 2 miles northeast of the discovery.

New Operations. — Nine new operations were reported, all development wells. Three were in the Rangely field in Colorado; one in Little Buffalo Basin, in Wyoming; one each in Bowdoin and Cedar Creek, in Montana, the latter being on the North Dakota side; and 2 in Fulcher Basin and 1 in Blanco, northwestern New Mexico.

Completions.—Nineteen wells were completed, of which 11 were oil, 5 were gas, and 3 were dry holes. Colorado had eight oil wells in the Rangely field; Wyoming three oil wells, one each in Big Sand Draw, Little Buck Creek, and Salt Creek. One of these, Sinclair-Wyoming Oil Co. 3 Unit in Big Sand Draw, the second oil well in that field in the Tensleep, flowed 695 bbl. of 34.1° crude. Montana had six completions, four gas wells and two were dry wildcats. Northwest New Mexico had one gas well at Fulcher Basin, and a test to the Dakota at Hospah, which was plugged back and completed in the Hospah sand.

MONTANA WILDCAT FAILURE

Devil's Basin, Musselshell County: Bill Clark 1 Northern Pacific, NE NW SW 9-11n-24e, TD 4,087 ft., dry and abd. Amsden, 590; Madison 2,625, Devonian 3,250 ft.

McDonald Creek, Petroleum County: Burks-Teigen 1 Teigen Brothers, NE NE NE 31-15n-25e, TD 1,242 ft., dry and abd., Morrison 925 ft., Ellis 1,240 ft., water.

BEAT

Soil Corrosion

This machine, especially developed for J-M by Crutcher-Rolfs-Cummings of Houston, double coats *and* double wraps *in* one *operation.*

in ONE operation with this Johns-Manville Machine

As fast as pipelines can be assembled, the Johns-Manville machine pictured here applies *double* protection against soil corrosion. TWO coats of enamel . . . TWO layers of J-M Asbestos Felts . . . go on in ONE single operation.

That means installation savings. And these savings continue through years of service because Johns-Manville Pipeline Felts are made of time-defying, rotproof asbestos fibers. It is today the most widely used material for guarding the enamel against soil stresses and distortion.

For complete information, write Johns-Manville, Box 290, New York 16, New York.

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Johns-Manville *ASBESTOS* Pipeline Felts

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Timken Tapered Roller Bearings not only help to keep oil field equipment operating efficiently, dependably and economically; they help to move it quickly and safely too.

The transport truck shown in the photograph loading a 15,000 lb. drawworks is equipped with a Braden 91-C Winch capable of handling the massive machines that regularly have to be moved in the oil fields. Timken Bearings are used exclusively in Braden Winches to assure smooth operation; full radial, thrust and combined load capacity; maximum endurance; and low maintenance.

To be sure of getting Timken Bearing performance in your equipment, look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

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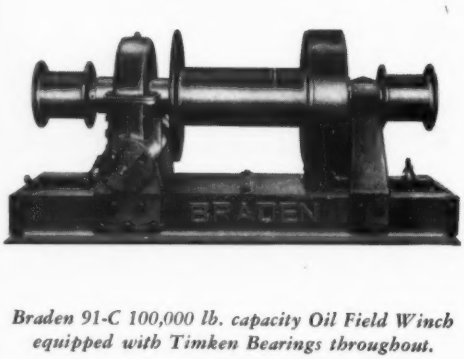

Braden 91-C 100,000 lb. capacity Oil Field Winch equipped with Timken Bearings throughout.

CALIFORNIA

Kern County Wildcat May Establish Depth Record

LOS ANGELES.—Establishment of a new world drilling-depth record in California appeared inevitable at end of last week. Pacific Western Oil Corp. et al 1 National Royalties, about 7 miles from the nearest production in any direction and in Kern County, was drilling below 16,593 ft.

The Pacific Western wildcat in 5-26s-22e, about 7 miles east of the Lost Hills field and approximately the same distance north of the Semitropic gas field, is projected to the Vedder in lower Miocene. The operating company is supported by several other concerns holding acreage in vicinity of the well.

At 16,593 ft., Pacific Western's project was only 62 ft. shy of the world drilling-depth record established last year in Phillips Petroleum Co. 3 Schoeps in Brazos County, Texas, which was abandoned at 16,655 ft. in Lower Cretaceous. The previous California drilling-depth record of 16,246 ft. established in 1944 at Standard Oil Co. of California 20-13 KCL, South Coles Levee, Kern County, was broken and surpassed several days ago. Current drilling progress in 1 National Royalties is at the rate of 20 ft. daily.

Third producer for the Anaheim Sugar pool, West Newport field, Orange County, was completed during the week adding significance to the discovery scored in August by A. W. Lyddon, Operator. The new well, Amerada Petroleum Corp. 64-7 Anaheim Sugar, 7-6s-10w, is a west offset to the discovery producer and was completed in the same sand. In completing its new producer, which incidentally is the first for Amerada in the Los Angeles Basin, the company plugged back to 5,550 ft. from total depth of 5,580 ft., and production through 20/64-in. choke was 400 bbl. daily of 16.9°-gravity crude.

Two drilling operations are nearing depth of the discovery producer in the Alondra pool, near Gardena community in western Los Angeles. The Alondra discovery well, British-American Oil Producing Co. and The Texas Co. 1 Bodger, 22-3s-14w, is producing from the conglomerate-schist at 9,093-9,154 ft. Initial production from the discovery well exceeded 1,000 bbl. daily on varied chokes. Future of the field is now at the crossroads. British-American 1 Alondra Park, also located in 22-3s-14w, is drilling at 9,080 ft. Since it is a deflected hole, the depth at which pay may be expected should be greater than in the discovery. Immediately south, The Texas Co. and Seaboard Oil Co. 9-1 Gardena community, 26-3s-14w, was coring at 9,271 ft. when the week closed.

A cluster of four wildcat operations are drilling or preparing to start operations which should provide more comprehensive information on the deep prospects around the Del Valle field and area. Barnsdall Oil Co. 1 Dodge, 32-5n-16w, and Republic Operators, Inc., 1 fee, 13-5n-17w, are drilling at shallow depths. The Republic project is about 4 miles north of Barnsdall's operation. Three miles west of the Republic test, Universal Consolidated Oil Co. is building roads to location for a test in Devils Canyon. Drill site selected is in 27-5n-17w. Six miles southwest of the Universal Consolidated test, Standard Oil Co. of California soon is to start a wildcat in 15-4n-17w. The location is about ½ mile north of production in the Del Valle field. Between the Standard of California and Universal Consolidated locations and slightly west of a direct line, Western Gulf Oil Co. is producing and developing its Oak Canyon field.

New locations announced during the week declined to 33, a reduction of 17 from the previous week's level. Since Thanksgiving intervened and many companies granted employes a long week end, the reduction in authorized locations appears to have little significance.

CALIFORNIA WILDCAT FAILURES

Orange County, Fairview area: Tide Water Associated Oil Co. 2 Norris, 8-6s-10z, swabbed salt water, dry, TD 6,536 ft.

Kern County, Buena Vista Hills area: Continental Oil Co. 1 BVA, 8-32s-25e, tested zone 3,177-90 ft. via gun perforations, recovered salt water, dry, TD 10,021 ft.

Antelope Hills area: W. L. Hernstadt 1 fee, 24-27s-19e, dry, TD 5,650 ft.

Mount Poso area: Mauer and Fisher 1 Corehole, 4-28s-29e, top granite 1,000 ft., hard granite 1,015 ft., dry, TD 1,019 ft.

San Emigdio area: Western Gulf Oil Co. 5 San Emigdio, 30-11n-22w, dry, TD 745 ft.

Solano County, Rio Vista area: Shell Oil Co., Inc., 1 Pressley, 16-3n-2e, recovered salt water on formation test 4,795-4,840 ft., dry, TD 8,025 ft.

Fresno County, Turk Anticline area: Superior Oil Co. 1 KCD, 13-17s-16e, dry, TD 10,509 ft.

Santa Barbara County, Cat Canyon area: Union Oil Co. B-1 Williams, 25-9n-33w, dry, TD 2,528 ft.

OHIO, KENTUCKY

North Extension for Mifflin Gas Field

COLUMBUS.—The Mifflin gas pool has a north offset extension by Roy Stewart 1 George W. Shenberger, Section 14, Mifflin Township, Ashland County. Clinton sand 2,436-44 ft., was gaged at 2,030,000 cu. ft. natural.

A new pool just south of or an extension to the East Avon Center pool was found by Wm. Dempsey on O. D. Bliss, Section 27, Avon Township, Lorain County. Clinton sand was reported at 2,381-95 ft. with 400,000 cu. ft. natural.

Two Medina sand wells and two Clinton wells were completed east of Duncan Falls in the Salt Creek field in Muskingum County. Cain et al 1 Delia Schlaegel, Section 29, Wayne Township, swabbed 35 bbl. from the Medina sand at 4,102-08 ft. The same operator completed 5 S. A. Bowman, Section 32, Wayne Township, in the Medina, good for 37 bbl. In Salt Creek Township, the Wasson Co. 2 Roy A. McConaha, Section 21, topped Clinton at 4,088 ft. and at 4,114 ft. gaged 5,500,000 cu. ft. The same company's 1 Hiram Hutson, Section 21, had 700,000 cu. ft. in the Clinton, logged at 4,066-96 ft.

The Industrial Gas wildcat test on Frank Northup, Section 9, Malta Township, Morgan County, found the Clinton at 4,256-99 ft. with 300,000 cu. ft. which blew out, and the Medina sand at 4,352 ft. with a hole full of water. A further test of the Clinton sand will be made.

Nine locations were reported for the week with four in Cambridge, three in Lancaster, and two in the Brush Creek field. Twenty-eight wells were completed with Sandyville (Canton) leading with 10.

OHIO WILDCAT FAILURE

Holmes County, Washington Township: Ohio Fuel 1 T. P. Butler, Sec. 30, Clinton 2,791-94 ft., TD 2,853 ft.

EASTERN KENTUCKY

ASHLAND.—Pike, Johnson and Knott counties came in for completions last week. Kentucky-West Virginia Gas Co. completed No. 829 on the S. B. Leslie farm, Pike County, at 3,112 ft., for 267,000 cu. ft. in the shale, and 67,000 cu. ft. in the Big lime. Same company's 5495 on the Aaron Justice property, Pike County, total depth 3,590 ft., made 67,000 cu. ft. in the shale and 123,000 cu. ft. in the Maxon. The company's 5666 on the John A. Music et al property, Johnson County, was good for 71,000 cu. ft. in the Big lime and the Corniferous, total depth 3,053 ft. Its No. 5671 on the J. Nichols property, Knott County, flowed 84,000 cu. ft. from the shale at 2,926 ft.

WESTERN KENTUCKY

OWENSBORO.—Activity in the western Kentucky area continued quiet during the past week with only one active wildcat reported under way. It was the Carter Oil Co. 1 Andy Blackwell, 7-O-23, Henderson County, which was waiting on cement after setting surface pipe.

Completions showed a slight gain, totaling seven for the week. Four of the completions were oil wells and three were dry holes, two of the latter being wildcats. New operations announced during the week totaled six, of which three were in Hender-

PUMPS for the PETROLEUM INDUSTRY

Write for Bulletin No. 102 which shows why and how

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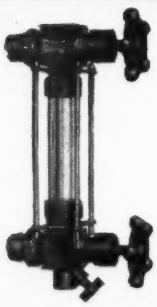

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son County, two in Daviess, and one in Union.

WESTERN KENTUCKY WILDCAT FAILURES

Henderson County: Fisher Oil Co. 1 W. I. Pritchett, 24-O-22, elev. 413 ft., dry at 2,730 ft., Tar Springs 1,933 ft., Glen Dean 1,990 ft., Cypress 2,280 ft., Aux Vases 2,520 ft., Ste. Genevieve 2,599 ft.

Hopkins County: H. H. Weinert 1 J. R. Breeden, 23-L-26, elev. 386 ft., temporarily abandoned after testing Pennsylvanian sand at 1,530-48 ft., TD 2,880 ft.

INDIANA

EVANSVILLE.—Possible westward extension of the Welborn pool of Vanderburgh County was indicated last week at the Basin Drilling Co. 1 L. F. Winkler, NW SE SW 31-6s-11w. Saturation was encountered in the McClosky lime at 2,516-22 ft., total depth 2,528 ft., and a 1-hour drill-stem test recovered 1,635 ft. of gas, 100 ft. of oil and 95 ft. of muddy oil. No water was indicated on the test, and 5½-in. casing has been set to 2,515 ft.

Henry Smith et al are installing pump to test their prospective Cypress sand discovery just east of the city of Princeton, in Gibson County. The well, 1 Owen Beloat, NW NW 8-2s-10w, previously swabbed 70 bbl. of fluid, 20 per cent salt water, from the Cypress at 1,827-30 ft. At the total depth of 1,830 ft. it was still in the saturated sand. If commercial, the 1 Beloat will open the first Cypress production in the area.

Indiana completions during the past week totaled six, and included four oil wells and three dry holes. No wildcat completions were reported. New operations announced during the week totaled 16, which were located 5 in Posey County, 3 each in Gibson and Knox, 2 each in Pike and Sullivan, and 1 in Hamilton County.

ILLINOIS

Wayne County Wildcat Running Structurally High

MATTOON.—The R. B. Martin and Illinois Oil Co. 1 French, SW SW SE 24-1n-9e, Wayne County wildcat 1½ miles southwest of the Bennington pool, was drilling ahead below 2,900 ft. at the end of the week, and was reported to be running higher structurally than other wells in the area. From an elevation of 391 ft. the Tar Springs sand was encountered at 2,445-2,502 ft., lower Glen Dean at 2,655-81 ft., and the Cypress sand at 2,863-78 ft. No oil shows have been reported as yet.

In Hamilton County, Shell Oil Co. 4 J. Nohava, SE SW NE 13-6s-5e, is drilling ahead below 4,900 ft. after topping the Warsaw at 4,371 ft. This test is located in the Dale-Hoodville Consolidated field, and is the first deep test in that area.

The Ben J. Taylor 1 John D. Hardinger, SW SW NE 21-12n-6e, Moultrie County wildcat, is shut down while operators are installing pumping equipment prior to testing the Aux Vases sand at 1,933-67 ft., total depth 2,011 ft. Before being shut in, the well had a small recovery of oil and salt water which indicated possible commercial production.

Illinois completions showed a decided drop during the past week, probably due to the Thanksgiving holidays. Completions totaled 31 for the week, and included 14 oil wells and 17 dry holes, 5 of the latter being exploratory ventures. New operations showed an upward trend, totaling 54 for the week. Nine of the new operations were wildcats which were distributed one each in Shelby, Effingham, Montgomery, Clay and Madison counties, and two each in Wayne and Washington counties.

ILLINOIS WILDCAT FAILURES

Clay County: Perry Fulk 1 Hawkins, SW SW NW 5-2n-9e, dry at 3,145 ft., Ste. Genevieve 2,998 ft., Fredonia 3,045 ft., McClosky 3,122 ft.

Effingham County: A. F. Steinberg 1 L. L. Seeley, SE SW NE 39-9n-5e, dry at 2,406 ft., Glen Dean 1,843 ft., Cypress sand 1,953 ft., Benoist 2,127 ft., Aux Vases 2,187 ft., Ste. Genevieve 2,233 ft., McClosky 2,324 ft.

Jefferson County: National Associated Petroleum Co. 1 E. Talbot et al, NW NW NW 1-2s-1e, dry at 2,406 ft., Glen Dean 1,715 ft., Cypress sand 1,934 ft., Weiler 1,979 ft., Benoist 2,095 ft., Aux Vases sand 2,172 ft., Ste. Genevieve 2,273 ft.

Marion County: Powell & Ria 1 Marlow, NE NW SW 30-4n-4e, dry at 2,438 ft., Glen Dean 1,876 ft., Cypress sand 2,063 ft., Benoist 2,198 ft., Aux Vases sand 2,251 ft., Ste. Genevieve 2,325 ft., Rosiclare 2,340 ft., McClosky 2,390 ft.

Wabash County: Inland Prod. 1 Bowles, SW SW NE 21-1s-13w, dry at 2,819 ft., Glen Dean 2,188 ft., Cypress sand 2,451 ft., Ste. Genevieve 2,685 ft., McClosky 2,737 ft.

LA.-ARK.

California Co. to Seek Oil in Ouachita Parish

SHREVEPORT.—The first recent petroleum exploration in gas-producing Ouachita Parish has been started by the California Co.'s wildcat test 8 miles east of Monroe. The test has been designated as the 1 Breece Lumber Co. Unit 1, and

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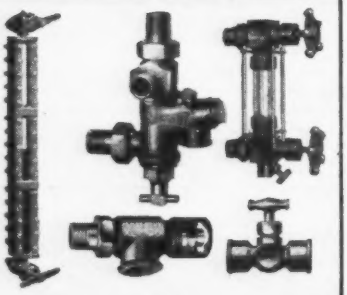

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is located in NW NW 3-17n-5e, approximately 13 miles northwest of the nearest oil-producing well in Richland Parish.

Interest in this area has also been centered around two wildcats in Franklin Parish during the past week. Gulf Refining Co. 1 Prudential Life Insurance Co., 3-16n-8e, encountered oil and gas at 3,155-70 ft. and hopes to discover a new and shallower sand. Murphy-Sun Co. A-11 J. E. Holt, 4-16n-9e, reached oil sand at 3,634-40 ft. with indicated commercial production, and has set casing at 3,759 ft. for completion test. It has not been determined whether this is the discovery of a new pool or an extension to the Delhi field.

In Richland Parish, R. T. Sellars and R. D. Kellogg 1 John Hemler, 12-16n-6e, had a show of gas and oil in the Rodessa zone at 2,999 ft., and is currently drilling below 3,130 ft.

In addition to 18 completions, 2 of which were dry wildcats, there were 15 new permits issued for North Louisiana this week. Arkansas had five completions, including one oil and one dry wildcat, and four drilling permits.

NORTH LOUISIANA WILDCAT FAILURES

Madison Parish: C. H. Osmond 1 Anderson-Tully, C SE SE 28-17n-14e, dry, TD 7,510 ft., Cook Mountain 1,197 ft., Sparta 1,338 ft., Cane River 2,305 ft., Wilcox 2,701 ft., Midway 4,620 ft., Gas Rock 5,100 ft., Eagleford 5,152 ft., Tuscaloosa 5,785 ft., Marine Tuscaloosa 6,272 ft., Massive sand 6,594 ft., Lower Cretaceous 6,690 ft.

Morehouse Parish: The Texas Co. 1 Doles, C SW SW 10-23n-8e, dry, TD 3,653 ft., Wilcox 1,554 ft., Midway 2,227 ft., Gas Rock 2,692 ft., Cotton Valley 2,852 ft., Smackover 2,909 ft., 1st Igneous 2,926 ft., alternate streaks of Smackover and Igneous 2,926-3,500 ft., solid Igneous 3,500 ft.

ARKANSAS SUCCESSFUL WILDCAT

Columbia County: McAlester Fuel Co. 1-D E. D. Harris, C NE SE 9-17s-19w, dual completion of new pay discovery, flowed 137 bbl. of 48.6°-gravity oil per day from Travis Peake at 4,770-98 ft. and 175 bbl. of 40.4°-gravity oil from Smackover lime at 7,357-59 ft., through 9/64-in. tubing choke, chalk 2,315 ft., Tokio

LEGAL

CALL FOR BIDS. To sell royalty crude oil accruing to the United States. Sealed proposals, in duplicate, will be received in the office of the Director of the Geological Survey, 5244 Federal Works Agency Building, Washington 25, D. C., on or before noon, December 17, 1946, for the sale under contract for a term of 3 years, effective the first day of the calendar month following execution of the contract by the Secretary of the Interior, of certain royalty crude oil accruing to the United States from Federal lands in the Kettleman Hills North Dome oil field in California, and from the Salt Creek oil field in Wyoming. The monthly royalty production during the calendar year 1945 from the Kettleman Hills field averaged about 65,400 barrels of crude oil of approximately 37° A.P.I. gravity. The monthly production for the same period from the Salt Creek field averaged about 32,500 barrels of crude oil of approximately 37° A.P.I. gravity. Specifications on the quantities of crude oil offered for sale, the form of bids, the form of contract, and the conditions with respect to bond requirements, deliveries, volume measurements, gravity determinations, and other details relative to the bids to be submitted should be obtained by bidders from the Director, Geological Survey, U. S. Department of the Interior, Washington 25, D. C., the Oil and Gas Supervisor, U. S. Geological Survey, 533 U. S. Post Office and Courthouse Building, Los Angeles 12, California, or the Oil and Gas Supervisor, U. S. Geological Survey, P. O. Box 400, Federal Building, Casper, Wyoming. Sealed bids must be submitted to the Director of the Geological Survey, Department of the Interior, Washington 25, D. C., pursuant to the specifications, the envelope to be marked plainly "Bid on Kettleman Hills North Dome Royalty Oil" or "Bid on Salt Creek Royalty Oil," whichever identification is applicable to the bid submitted, "Not to be opened before noon, December 17, 1946." No bid received after the time fixed herein for submitting bids will be considered. Oscar L. Chapman, Acting Secretary of the Interior.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Wind River Indian Agency, Fort Washakie, Wyoming, November 15, 1946. Notice is hereby given that SEALED BIDS will be received until 2:00 P.M. December 20, 1946, at the Wind River Agency, Fort Washakie, Wyoming, for the leasing of the following parcels of Tribal lands, located in Fremont County, Wyoming, for oil and gas mining purposes. TOWNSHIP 6 NORTH, RANGE 3 WEST, W.R.M. UNIT No. 1, All interest in the S½ SW¼ and SW¼ SE¼ of Sec. 22; N½ NW¼, NW¼ NE¼, S½ NE¼ and N½ SE¼ of Sec. 27—containing 400 acres. UNIT No. 2, All interest in the E½ SW¼ and W½ SE¼ of Sec. 26; and W½ NE¼ of Sec. 35—containing 240 acres. UNIT No. 3, All interest in the SE¼ SW¼ of Sec. 23; and E½ NW¼ of Sec. 26—containing 120 acres. UNIT No. 4, An undivided ½ interest in the SE¼ SE¼ of Sec. 22; and SW¼ SW¼ of Sec. 23—containing 80 acres. Special attention is invited to the fact that Unit No. 4 is being offered with the understanding that the lease to be issued therefor will cover only 50 per cent of the oil and gas mineral rights. The remaining ½ interest of the mineral rights for this 80 acre tract is held in fee by a non-Indian owner and therefore is not under the supervision of this Office. Separate leases will be drawn on the applicable government form for each of the described four units. Bids may be made on one or more of the described units. The right is reserved to reject any and all bids. The successful bidder or bidders will be required to pay the cost of advertising, such cost to be prorated if there is more than one successful bidder. The leases will be sold to the highest bidder for a bonus offer upon an acreage basis in addition to the royalty of 12½%. The successful bidder or bidders must enclose with their bids, a certified check or bank draft drawn upon a solvent bank in an amount equivalent to at least 20% of the bonus bid plus 20% of the first year's rental at the rate of $1.25 per acre per annum, as a guaranty of good faith. The checks are to be made payable to the TREASURER OF THE UNITED STATES. The leases must be completed and filed with this Office within 20 days from the date they are received by the successful bidder for execution and accompanied by payment of the remainder of the bonus bid, the balance of the first year's rental and the filing fee of $5.00 for each separate lease. Failure in any of these conditions may subject the bid to cancellation without further notice and forfeiture of payments already made. The lessee will be required to use diligence in drilling operations and the lessee alone or in conjunction with other lessees in this area shall start and complete within one year from date of approval of the lease to the satisfaction of the Geological Survey a test of the oil producing possibilities of the Tensleep formation, unless oil or gas in commercial quantities is found at a lesser depth or the Geological Survey shall determine that further drilling in the well would not be warranted. The leases to be issued for the described four units of Tribal land will be made for a term of 10 years and as long thereafter as oil and/or gas is produced in paying quantities in accordance with the provisions of the Act of May 11, 1938, 52 Stat. 347 and the regulations approved May 31, 1938, Title 25, Code of Federal Regulations, Part 186. The rate of royalty will be 12½ per cent of the value of all oil, gas, and/or natural gasoline unless the lessor, with the approval of the Secretary of the Interior elects to take royalty in kind. The adequacy of the bonus offers will be determined by the Geological Survey. A suitable bond will be required and such bond must be approved by the Department. The responsibility of complying with any requirements of the Federal Documentary Stamp Statutes will be left with the successful lessees. All bids should be addressed to the Superintendent, Wind River Agency, Fort Washakie, Wyoming, in a plain envelope, marked: BID FOR OIL AND GAS MINING LEASES, DRY CREEK FIELD, TO BE OPENED 2:00 P.M. DECEMBER 20, 1946. For further information call or write Mr. Waller, Land Division, of the Wind River Agency. J. M. COOPER, Superintendent.

2,608 ft., James 3,605 ft., Basal James 3,690 ft., Buckrange 7,184 ft., TD 7,362 ft.

ARKANSAS WILDCAT FAILURE

Ouachita County: Jack Carnes et al 2 Myar Bros., C SW SW SE 14-13s-19w, dry, TD 2,611 ft., no tops reported.

OKLAHOMA

Oklahoma Wildcatters Have Successful Week

A HIGH percentage of success was noted in Oklahoma exploratory activity during the past week as five discovery wells were completed in three counties. The discoveries, all apparently of secondary importance, included four for oil and one for gas.

In Hughes County, Sherrod & Apperson 1 Barnard, SE SW NE 23-8n-8e, was completed on pump for 60 bbl. of oil daily from the Wapanuka-Union Valley lime at 3,284-96 ft., total depth. It was acidized with 3,000 gal.

Okfuskee County received two oil discoveries and the single gas discovery of the week. The T. N. Berry 1 Catlett, NE NW SW 29-10n-11e, was credited with a discovery when it was completed in the Boock sand, topped at 2,262 ft. The well was drilled to 3,155 ft. in the Cromwell and then plugged back to 2,290 ft. where it was completed flowing 13 bbl. of oil and 30 bbl. of water per day initially. Also in Okfuskee County, the Mid-Continent Petroleum Corp. finaled its 1 Baker, SE NE NW 31-12n-7e, as a 20-bbl. pumped from the Prue sand at 4,315-45 ft. The gas discovery was the Loftis Drilling Co. 1 Kenneda Unit, NE NE SE 14-12n-9e, which flowed 6,750,000 cu. ft. of gas with a small amount of oil from the Hunton lime at 3,680-91 ft., total depth 3,705 ft.

The fourth new pool during the week was in Pottawatomie County where the James S. Wise 1 State, NE NE NW 16-10n-5e, was completed in the Earlsboro sand following a 12-qt. shot at 3,805-17 ft. Initial production was gaged at 32 bbl. of 36°-gravity oil on pump.

Completion of new gathering lines by Stanolind has provided the new Cotton County pools with an increased outlet and permitted production to climb to 8,755 bbl. daily. This figure is for the week ended November 30, while production for the previous week averaged approximately 6,100 bbl. daily.

OKLAHOMA WILDCAT FAILURES

Comanche County: Kingery Brothers 1 Doyle, C SE NW 7-4n-11w, dry, TD 2,516 ft., lime 1,100 ft., lime and conglomerate 2,098-101 ft.

Cotton County: A. Kriss et al 1 Cain, SW SW NW NE 3-3s-11w, dry, TD 2,372 ft., sand 1,648 ft., Megargel lime 2,120 ft., sand 2,343 ft.

Ted Norwood 1 Creswell, SE SE SE NE 17-4s-10w, dry, TD 1,534 ft., no tops reported.

D. H. Bolin 1 Collins, SW SE SW SW 33-2s-9w, dry, TD 2,607 ft., sand 1,328-42 ft., 1,880-87 ft. and 2,385-409 ft., broken sand 2,483-524 ft., shale and sand 2,571-607 ft.

W. H. Spradlin 1 Hale, NE NW SW NW 17-5s-12w, dry, TD 2,011 ft., sand 1,505-15 ft. and 1,550-70 ft. with no show.

R. L. Fisher 1-A Dugan, NW NW SW SW 5-5s-12w, dry, TD 1,560 ft., sand 1,521-24 ft. with no show.

S. D. Johnson and McGurrie 1 McGee, SW SW SW NE 25-2s-14w, dry, TD 3,015 ft., Granite Wash 1,395 ft., sand 1,523-29 ft., sand and lime 1,529-40 ft., lime 1,540-66 ft., sand 1,588-96 ft., 1,760-75 ft. and 1,800-05 ft., lime 1,960-2,034 ft.

S. F. Hutcheson and Ed Peterson, Jr. 1 Eller, NW NW NW NW 36-1s-12w, dry, TD 2,352 ft., sand 1,002-45 ft., lime 1,045-55 ft., sand 1,075 ft., lime 1,102-05 ft., 1,129-25 ft. and 1,188-92 ft., sand 1,608-13 ft., lime 1,892-98 ft., and 2,020-66 ft.

Garvin County: Helmerich & Payne 1 S. C. Newbern, NE NE NE 33-4n-3e, dry, TD 2,976 ft., sand 2,199 ft., dolomitic sand 2,833 ft., sand 2,940 ft.

Jefferson County: C. P. Burton 1 Melton, SE SE NW 8-4s-8w, dry, TD 2,504 ft., no tops reported.

Logan County: G. M. Piggott and Phillips 1 Frey, NW SE NW 22-19n-2w, dry, TD 5,577 ft., Oread 2,965 ft., Avant 3,580 ft., Perry 3,775 ft., Woodford 5,210 ft., Sylvan 5,260 ft., Viola 5,310 ft., dolomite 5,376 ft., Wilcox 5,401 ft., 2nd Wilcox 5,418 ft.

McClain County: Carter 1 Hastings, C SE NW 29-7n-3w, dry, TD 10,901 ft., Hogshooter 7,200 ft., Woodford 9,800 ft., Hunton 10,003 ft., Sylvan 10,210 ft., Viola 10,359 ft., Bromide dense 10,675 ft.

Oklahoma County: Double R Drilling 1 M. J. Reinhardt, SW SW NW 34-14n-1e, dry, TD 5,904 ft., Checkerboard 4,351 ft., Oswego 4,884 ft., Prue absent, Verdigris 5,033 ft., Bartlesville 5,195 ft., Viola 5,590 ft., 2nd Wilcox 5,842 ft.

Payne County: E. K. Cary and Derby 1 State, SE NW NW 36-18n-4e, dry, TD 4,185 ft., Tonkawa sand 2,100 ft., Hogshooter 2,460 ft., Layton 2,512 ft., Checkerboard 2,800 ft., conglomerate 2,820 ft., Oswego 3,190 ft., Prue 3,325 ft., sand 3,350 ft. with stain and odor of oil, Skinner 3,530 ft., Red Fork 3,610 ft., Inola 3,670 ft., Bartlesville 3,696 ft., Misener 4,044 ft., Sylvan 4,047 ft., Viola 4,075 ft.

OKLAHOMA SUCCESSFUL WILDCATS

Hughes County: Sherrod & Apperson 1

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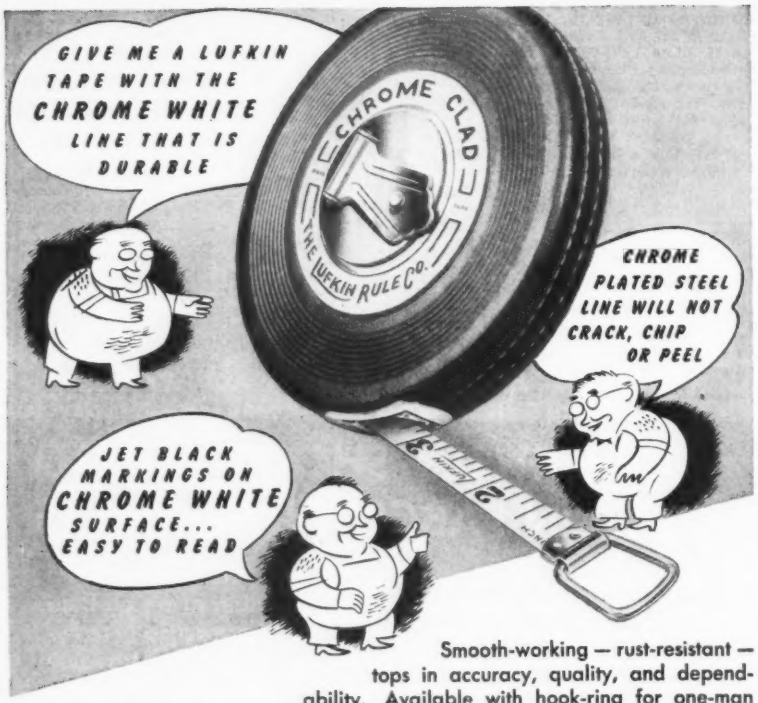
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DANVILLE, ILLINOIS

Barnard, SE SW NE 23-8n-8e, discovery 1 mi. east of NE Wewoka, pumped 60 bbl. of 38°-gravity oil per day from Wapanucka-Union Valley at 3,286-95 ft., coal 1,480 ft., Senora lime 1,576 ft., brown lime 2,662 ft., Upper Booch 2,762 ft., Lower Booch 2,830 ft., Gilcrease 3,011 ft., TD 3,296 ft.

Leach & Moore 1 Morris, SE NW SE 7-9n-10e, gas discovery near SE Papoose pool, Lower Wewoka 520 ft., Calvin 690 ft., Senora 1,370 ft., brown lime 2,465 ft., Booch 2,641-80 ft., Gilcrease 3,058-62 ft., TD 3,067 ft.

Okfuskee County: R. Fillmore 1-A L. T. Palmer, C SE NW 34-11n-10e, gas discovery 3 mi. east of Okemah pool, production from 3,069-94 ft., Gilcrease 3,051 ft., TD 3,123 ft.

Seminole County: G. W. Hassell Service, Inc. 1 H. Walker, NE SE NW 29-7n-6e, pumped 10 bbl. of 34°-gravity oil per day from Calvin at 2,403-17 ft., discovery north of Dora pool, TD 2,417 ft.

KANSAS

Doran Pool Extended Half-Mile Northward

THE Doran pool of western Rice County was extended ½ mile to the north during the past week when the Keys Drilling Co. 1 Flora, SW SW SE 12-19-10w, was completed for a potential of 742 bbl. daily. Production was from the Arbuckle lime topped at 3,256 ft. Total depth of the well was 3,262 ft.

Cities Service Oil Co. last week announced location for a key wildcat to be drilled in the heart of the Salina basin in north central Kansas. The venture will be the 1 Blake "B," NE NW NE 8-8s-4w, about 4 miles northeast of Glasco in the southwestern part of Cloupd County. The Salina basin contains numerous surface features which have attracted the attention of several companies during recent years. Nearest production to the present location, however, is about 50 miles to the southeast in the Salina pool.

Stanolind Oil & Gas Co. has completed its 1 A. W. Wikle, NW SW 10-2s-15e, rank wildcat in Brown County of northeastern Kansas, as a dry hole at a total depth of 3,435 ft. The well was drilled through the Lansing, topped at 1,284 ft., the Mississippi at 2,592 ft., and the Hunton at 3,036 ft. without recovering any shows of oil except a small trace during a drill-stem test at 3,036-3,102 ft.

KANSAS WILDCAT FAILURES

Barber County: Skelly Oil 1 A. N. Harbaugh, SW NE NE 15-33s-12w, dry, TD 4,950 ft., Douglas 3,715 ft., Mississippi 4,390 ft., Misener 4,683 ft., Viola 4,686 ft., Simpson 4,789 ft., Simpson sand 4,836 ft., Arbuckle 4,924 ft.

Barton County: Royer & Farris 1 Jurgenson, SE SE NW 16-19s-13w, dry, TD 3,523 ft., Lansing-Kansas City 3,210 ft., Arbuckle 3,446 ft.

Ellis County: Aylward Production et al 1 Skaggs, NW NW SE 6-12s-20w, dry, TD 3,965 ft., anhydrite 1,675 ft., Heebner 3,542 ft., Lansing-Kansas City 3,567 ft., Arbuckle 3,935 ft.

Harvey County: J. E. Palenski 1 C. S. Meetz, C S/2 S/2 SE 33-22s-2e, dry, TD 2,505 ft., Kansas City 2,225 ft.

Kingman County: Stickel Drilling 1 Van Devanter, SW NW SW 9-28s-6w, dry, TD 4,432 ft., anhydrite 1,010 ft., Lansing-Kansas City 3,044 ft., Mississippi lime 3,846 ft., Kinderhook 4,134 ft., Misener 4,227 ft., Viola 4,232 ft., Simpson sand 4,286 ft., Arbuckle 4,392 ft.

Rooks County: Doley Oil 1 Henderson, SW SW NW 23-10s-19w, dry, TD 3,699 ft., anhydrite 1,475 ft., Topeka 3,088 ft., Lansing-Kansas City, 3,331 ft., cherty conglomerate 3,598 ft., Simpson shale 3,650 ft., Arbuckle 3,679 ft.

P. M. Polhamus and Anderson-Prichard 1 Frank Veverka, NW NW SW 21-8s-19w, dry, TD 3,523 ft., anhydrite 1,460 ft., brown lime 3,190 ft., Lansing-Kansas City 3,197 ft., conglomerate 3,464 ft., Arbuckle 3,486 ft.

Rush County: William Cross and E. Eresch 1 Oet Kin, NW NW SE 11-19s-16w, dry, TD 3,785 ft., anhydrite 1,080 ft., Heebner 3,329 ft., Lansing-Kansas City 3,415 ft., Basal Kansas City, 3,636 ft., Layton sand 3,770 ft.

Saline County: D. D. Fowler et al 1 Bickel, NE NE SE 22-16s-1w, dry, TD 2,638 ft., Mississippi lime 2,633 ft.

Shawnee County: Charles Key 1 Mary E. Renyer, NE NE NE 18-13s-16e, dry, TD 2,268 ft., Mississippian 1,820 ft., Hunton 2,230 ft., Viola 2,253 ft.

Sheridan County: Stanolind Oil & Gas 1 Charles D. Wiman, SE SE SE 3-10s-27w, dry, TD 4,674 ft., anhydrite 2,205 ft., Topeka 3,570 ft., Lansing-Kansas City 3,805 ft., Mississippi lime 4,413 ft., Arbuckle 4,604 ft.

•

Canadian Crude-Oil Output Shows Gain

OTTAWA. — Canadian crude-oil production, which has shown a large drop since the end of the war, registered a slight increase in September with a total output of 624,954 bbl., or a daily average of 20,832 bbl. The August figure was 623,287 bbl., or a daily average of 20,106 bbl. In 1945 the September production was 657,239 bbl., or a daily average of 21,908 bbl.

During the 9 months ending in September, production totaled 5,753,347 bbl., against 6,560,803 bbl. for the same period in 1945.

Natural-gas production in September was 3,558,240,000 cu. ft., against an August figure of 3,270,833,000 cu. ft. Natural-gas output in September 1945 was 3,696,816,000 cu. ft.

CALENDAR

December

Houston Nomads, Old College Inn, Houston, December 9.

Interstate Oil Compact Commission, winter quarterly meeting, Dallas, December 9-11.

Petroleum division, National Association of Credit Men, annual conference, Congress Hotel, Chicago, December 9-11.

Oil Dealers Association of Arkansas, Hotel Marion, Little Rock, December 10.

Los Angeles Nomads, Mayfair Hotel, December 11.

American Chemical Society, meeting of Texas sections, Dallas, December 12-13.

Mid-Continent Oil and Gas Association, annual ad valorem tax forum, Plaza Hotel, San Antonio, Tex., December 16-18.

American Institute of Mining and Metallurgical Engineers, technical meeting sponsored by the five Texas sections, University of Texas, Austin, December 18-19.

Texas Railroad Commission, hearing on operations of carbon-black plants, Austin, December 19.

Texas Railroad Commission, state proration hearing, Austin, December 20.

1947

January

Society of Automotive Engineers, annual meeting and engineering display, Book-Cadillac Hotel, Detroit, January 6-10.

March

American Institute of Mining and Metallurgical Engineers, annual meeting, and World Conference on Mineral Resources, Waldorf Astoria Hotel, week of March 17.

Western Metal Congress and Exposition, Oakland, Calif., March 22-27, 1947.

Western Petroleum Refiners Association, annual membership meeting, San Antonio, March 24-26.

Oil Heat Institute of America, annual convention, Traymore Hotel, Atlantic City, N. J., March 24-30.

April

National Association of Corrosion Engineers, annual convention, Palmer House, Chicago, April 7-10, 1947.

Southern Gas Association, Biloxi, Miss., April 16-18.

Division of Production, American Petroleum Institute, Eastern District spring meeting, Pittsburgh, April 16-18.

Natural Gas Department, American Gas Association, spring meeting, Stevens Hotel, Chicago, April 30-May 2.

May

Division of Production, American Petroleum Institute, Mid-Continent District spring meeting, Amarillo, Tex., May 22-23.

Division of Production, American Petroleum Institute, Pacific Coast District spring meeting, Los Angeles, May 15-16.

Indiana Gas Association, Springs Hotel, French Lick, May 15-16.

Pennsylvania Gas Association, Wernersville, Pa., May 20-22.

June

Canadian Gas Association, General Brock Hotel, Niagara Falls, N. Y., June 16-18.

September

Pacific Coast Gas Association, Coronado Hotel, San Diego, September 23-25.

American Gas Association, annual convention, San Francisco, September 29-October 3.

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Among the

Drilling Contractors

S. W. S. Drilling Co., of which J. L. Wilson is manager, has moved its warehouse and equipment from Vermilion to Lloydminster, Alta.

Atlantic Oil Co., Los Angeles, has been awarded contract for Del Amo Estate Co. 42 well in the Torrance field, Los Angeles County, California.

Delta Drilling Co. has derrick up and was moving in rig at Standard Oil Co. of Kansas' wildcat, the 1 G. A. Lundy et al, 4½ miles northwest of Porter Springs, Houston County, Texas. Contract depth is 8,000 ft.

Pike Drilling Co., Los Angeles, has been awarded contract for drilling The Texas Co. 1 Dahlgren, a wildcat operation in 7-16s-15e, Fresno County, California, in the Cantua Creek area.

General Petroleums of Calgary, Alta., is completing Shaw Petroleums 4, LSD 15, 35-49-1w4, in the Alberta end of the Lloydminster field, with oil sand at 1,892 ft.

Virginia Drilling Co. has staked location for the 1 Rose in NE NE SE 22-21s-12w, Stafford County, Kansas. The test is a between-pool play located near production in the Sitner, Syms, and Mueller pools in the northern part of the county.

Crow Drilling Co. is contractor for the Ormond Corp. et al 1 Douglass Wynn, NE SE 12-17n-8w, a wildcat test in Washington County, Mississippi. Location of the test is 4 miles east of Swiftwater.

Gene Reid Drilling Co., Bakersfield, has received contract to drill Julius and Doeothy Fried 8 J. & D. in the Midway-Sunset field, Section 34-32s-24e, Kern County, California. The same firm has contracted to drill Amerada Petroleum Corp. C-1-22 Siegfus in the Ant Hill field.

Noble Drilling Co. is installing rotary equipment for a rank wildcat test to be drilled in Kiowa County, Kansas, on contract for Stanolind Oil & Gas Co., Lion Oil Co., and Panhandle Eastern Pipe Line Co. Location for the test, the 1 Sealy, is in NW NW NW 25-30-18w, 8 miles east of the Alford gas pool and on a block of 10,000 acres controlled by the operators. It is based on core-drill information and will go to the Arbuckle.

T. & T. Oil Co., Yorba Linda, is contractor for A. H. Bradford who is to drill 4 Hartwell in the Richfield area in Orange County, California.

Martin Harris Drilling Co. is rigging up rotary tools to begin operations at the 1 Swift-Hunter, SE SE NE 18-8n-7e, Monroe County, Alabama. The well will be drilled on contract for McDermitt Co.

B. & R. Drilling Co. has spudded surface hole for Mazda Oil Co. 1 Henderson "D," SW SW SW 27-11s-18w, a 3,800-ft. Arbuckle wildcat in northern Ellis County, Kansas. The venture is situated in an open area sur-

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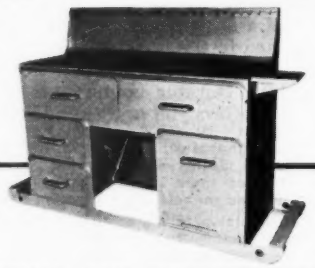

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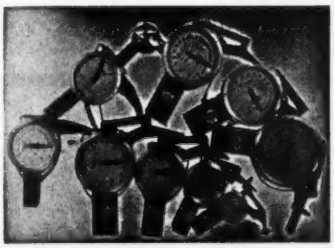

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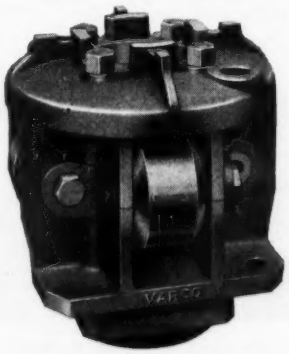

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rounded by the Riverview, Burnett, Shutts, and Walters oil pools, with nearest production lying approximately 2 miles distant.

Penrod Drilling Co. will drill the M. F. Wiggins, NE SE 15-6s-20e, Bradford County, Florida, on contract for Tide Water Associated Oil Co. Rigging up operations are now under way at this wildcat location.

Falcon Seaboard Drilling Co. will start activity this week at the 1 Patterson, NE SE NW 20-13n-5e, wildcat in Lincoln County, Oklahoma. This venture is approximately 1 mile northeast of a small Wilcox pumper completed last year at the Midstates 1 Barnes, SW SE 19-13n-5e.

A. W. Hutchings Drilling Co. has been awarded contract by Woodley Petroleum Co. to drill a wildcat in NW SW 36-1n-6e, Smith County, Mississippi. The well will be known as the 1 Womack Butler, and the location is 10 miles south and 7 miles west of Raleigh.

F. J. Fleming, of Evansville, Ind., is contractor for the Calvert & Willis et al 1 D. Donald, NE NE SW 18-5s-13w, Posey County. This test, located in the New Harmony South field, is scheduled to go to 3,050 ft.

Vic & Van Operating Co. has been contracted to drill the Frank J. Rief 1 Joseph F. Kelly, SW NE NE 23-5s-14w, Posey County, Indiana. The 1 Kelly will be a 3,000-ft. test in the New Harmony South field.

George & Wrather Drilling Co. are drilling ahead below 350 ft. at the 1 M. Frichtl et al, NW SW NE 27-7n-10e, Jasper County, Illinois. This well is being drilled on contract for Sam Malis in the North Willow Hill pool.

Olds Drilling Co. is contractor for the Hageman & Ponds 1 Warner, NE SW SW 23-3n-11w, a development well in the Herbert pool of Lawrence County, Illinois. Materials were being moved in at last report.

John O'Neal, Lubbock, Tex., moved in rotary last week to drill Ralph Lowe 1 Ruth S. Blake, a wildcat in Section 1,200, I&GN Survey, Garza County, Texas. Location is about 6 miles northwest of the town of Post and some 7½ miles northwest of nearest production in the Garza field. Contract depth was said to be 4,200 ft.

Canadian Fuel Oil Hiked

OTTAWA.—Oil companies in British Columbia have been authorized by the Canadian Prices Board to increase the price of their heavy fuel oil 15 cents a barrel. Higher costs of crude from California were cited as justifying the increase.

"It won't be long now, boss!

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PERSONALS

Swensrud Named to Ohio Standard High Post

FROM a Northwood, Iowa, farm to the position of executive vice president of Standard Oil Co. (Ohio) is the story of Sidney A. Swensrud, whose appointment to the new post was announced last week by W. T. Holliday, Ohio Standard president.

Swensrud, vice president in charge of production, transportation, and supply since 1939, joined the company in 1928 as assistant to the president and head of the department of business research.

He had spent the previous year, following 2 years of study in the Harvard School of Business, as a member of the school's faculty in the marketing-research department.

Son of an Iowa farmer, Swensrud attended Northwood High School. He was graduated from the University of Minnesota in 1923 and spent 2 years with Washburn - Crosby in sales-analysis work before continuing his studies at Harvard.

Kenneth A. Henderson, securities adviser to the Bank of Canada since 1935, has been elected vice president and appointed treasurer of Imperial Oil, Ltd.

George H. Evans. former senior chemical engineer at the Point Breeze, refinery of Atlantic Refining Co., has been named foreman of the wax plant.

John Bouquio, engineer in the Bayway, N. J., refinery of Standard Oil Co. of New Jersey, was recently notified by the War Department that he had been awarded an Army Commendation Ribbon for "exceptionally meritorious conduct" as assistant executive officer in the Office of the Service Command Engineer during the war.

Four men in the Bayonne refinery, Standard Oil Co. of New Jersey, have been appointed refinery foremen. They are: **Terence Bredin, John J. Clougher, John J. Hafner** and **Edward F. Mooney.**

E. G. Dobson, Louisiana petroleum engineer, has joined the Texas Petroleum Co. in Colombia.

L. R. Morris, assistant manager of Richmond Petroleum Co. of California, has returned to Colombia from a business trip to Venezuela.

C. F. SMITH

Chester F. Smith, a director of Standard Oil Co. (N. J.) and for more than 35 years associated with the company in manufacturing and engineering operations, has been named a vice president effective December 1. Since 1944, Smith has been chairman of Jersey Standard's coordination committee, a central study and advisory group for the managements of companies in the Jersey group. From 1940 until his appointment as a director, Smith was president of Standard Oil Co. of New Jersey, the principal refining and marketing subsidiary of the parent company. Smith's appointment increases the number of vice presidents of Jersey Standard to four. The others are **Orville Harden, John R. Suman,** and **Robert T. Haslam.**

E. A. Higgins, former liaison representative in New York with Asiatic Petroleum Corp., is now in Colombia with Cia. de Petroleo Shell de Colombia where he expects to be for at least several months.

J. H. Reese has been named safety engineer in West Texas for Shell Pipe Line Corp. He has been succeeded as personnel representative by **O. W. Gaul. F. L. Underwood** has been named safety engineer for the Texas-Gulf area.

Dr. Katherine W. Carman, Illinois district geologist for Great Lakes Carbon Corp., has resigned.

Lloyd Summers, general superintendent of the Lake Maracaibo district for Creole Petroleum Corp., and **E. F. Blakesley,** personnel director in Colombia for Tropical Oil Co., are now on vacation in the United States.

A. del Rio has resigned as chief of Colombia's geological survey, Ministry of Mines and Petroleum, to make a survey for the ministry of coal deposits of North Santander (Pamplona region). **Roberto Sarmiento Soto** has been named the new geological survey chief.

Eric W. Luster, chief engineer; **Leo W. Schrader,** head of the design and drafting division, and **Harold J. Strohoeffer,** of cost-estimating division, Standard Oil Development Co., have been honored by gifts and a party in recognition of 30 years of service each with the Esso Engineering Department.

D. M. Engel, general production superintendent of Cia. Consolidada de Petroleos (Sinclair) was in New York during the first 2 weeks of November. He has since returned to Venezuela.

Earl D. Wallace and **Samuel H. Elliott** have been elected vice presidents of Standard Oil Co. (Ohio). An-

E. D. WALLACE

S. H. ELLIOTT

nouncement of their election by **Pres. W. T. Holliday** followed division of the company's production, supply, and transportation department into three separate main departments. Wallace will head the production department. Elliott will be in charge of the transportation department. **Richard C. Sauer** has been named head of the supply and distribution department.

R. W. Lange has opened offices as a consulting geologist - engineer in Garden City, Kans. He formerly was with Amerada Petroleum Corp. in California.

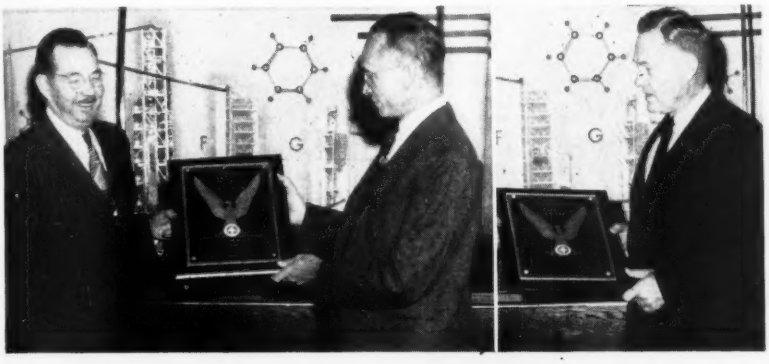
Frank E. Lyons was named acting secretary of a group of Titusville, Pa., oil men who met recently to begin plans for organizing a district oil-producers association.

R. V. Whetzel, foreign division manager of Cities Service Co. and a director of Companias Unidas de Petroleo (Tri-Pet Corp.) is in Bogota and plans to remain for at least 4 months as manager of the Colombian company which is owned by Cities Service, Sinclair Oil Corp. and Richfield Oil Corp. of California. Whetzel is also a director of the Sinclair Panama Oil Corp.

R. K. Dickie of D'Arcy Exploration Co., Ltd., and **D. Cousins** of Anglo-Iranian Oil Co., Ltd., are touring the United States gathering information on secondary-recovery techniques.

F. W. WILLIBRAND

Frank W. Willibrand, general superintendent of production operations, Standard Oil Co. (Ohio), has been named general manager of the Mid-Continent division, and **George S. Buchanan,** manager of the Houston district of the Sohio Petroleum Co. has been appointed general manager of the Gulf Coast division. Standard's new Gulf Coast division includes the Houston, Shreveport, and Jackson districts, and the Mid-Continent division, also newly organized, includes the Oklahoma, Kansas, North, and West Texas districts.



Safety is the theme of the above pictures, all of Socony-Vacuum Oil Co., Inc., employes as they received awards for outstanding safety records. At top, J. L. Risinger, of Socony-Vacuum's claim and safety department, presents Clark S. Teitsworth, manufacturing-committee chairman, a plaque attesting the best safety record in manufacturing operations of all large petroleum companies in the nation as determined by the National Safety Council. R. R. Irwin, right, of the manufacturing and pipe-line department, White Eagle Division, receives award for best record for crude and products pipe lines operations among 21 companies in Group B of the national contest. Below, David V. Stroop, director of American Petroleum Institute's department of safety, presents an A.P.I. certificate to Dr. John E. Schott, chairman of Socony-Vacuum's technical-service laboratory safety committee, for the laboratory's record of more than 2½ years without a disabling injury. Other members of the committee shown are Lee Lambert, Hans R. Gohlke, Charles L. Patterson, Mrs. Rowena Roberts, Miss Lilly Jaep, and Harry Albert. Another National Safety Council award went to Socony-Vacuum's Lubrite Division refinery at East St. Louis, Ill., for completing one year without a disabling accident. The period represented 971,000 man-hours of work

Vincent Emanuel has resigned as design and construction supervisor for Stanolind Oil & Gas Co., Tulsa, to join Grant Oil Tool Co., Los Angeles.

Charles R. Allen, former proration engineer for Continental Oil Co., has been appointed California region pro-

C. R. ALLEN

R. E. COLLOM

duction manager, with headquarters in Los Angeles. Allen will succeed **R. E. Collom,** vice president, who has been in charge of Continental's California production operations for the past 15 years and whose resignation became effective December 1. Collom will continue to serve as director of the Kettleman North Dome Association. Allen has been on Continental's production staff more than 23 years.

SHIFTS—

Edward P. Rogers, engineer, The Fluor Corp., Alhambra, Calif., to Los Angeles; **Warren E. Ten Eyck,** engineer, Long Beach, Calif., to Bakersfield; **Fred M. Emerson,** engineer, A. D. Muckleroy Co., Douglas, Tex., to Pasadena, Tex.; **J. R. Gilliland,** foreman, General Geophysical Co., El Campo, Tex., to Holyoke, Colo.; **Sheldon Ward,** superintendent, Shell Oil Co., Olney, Tex., to Nacona, Tex.

Max E. Riley, engineer, Sunray Oil Corp., Alice, Tex., to Premont, Tex.; **William Horblett,** engineer, Humble Oil & Refining Co., Baytown, Tex., to Goose Creek, Tex.; **J. J. Pitts,** engineer, Robert H. Ray, Inc., Beaumont, Tex., to Conroe, Tex.; **James F. True,** superintendent, Sinclair Refining Co., Corpus Christi, to East Chicago, Ind.

Leo A. Hatten, engineer, Beaumont Cement Sales Co., Kermit, Tex., to Odessa, Tex.; **J. T. Drindak,** engineer, Union Producing Co., McAllen, Tex., to Shreveport, La.; **Harry E. McDonald,** engineer, Shell Oil Co., Inc., Odessa, Tex., to Eastland, Tex.; **James E. Wilson,** geologist, Shell Oil Co., Inc., Tyler, Tex., to Houston.

R. L. Gallaway, foreman, The Texas Co., Franklin, La., to Donaldsonville, La.; **J. M. Bugbee,** engineer, Shell Oil Co., Inc., Lake Charles, La., to Premont, Tex.; **E. Clarence Oden,** engineer, Cities Service Refining Corp., Cullman, Ala., to Lake Charles, La.; **R. C. Heil,** engineer, The Texas Co., Salem, Ill., to Farina, Ill.; and **G. G. Jauchius,** superintendent, Pure Oil Co., Temple, Mich., to Newark, Ohio.

Equipment Men in the News

First National Repeats for Third Consecutive Year

The efforts of Roscoe Adams, cashier of The First National Bank & Trust Co., Tulsa, were justly rewarded recently when that bank was awarded "Highest Merit Award" for its annual report for the third consecutive year by Financial World in an annually conducted survey. Advertising is handled by Stanley J. Ehlinger Advertising Associates, Inc.

Hamric Elected Vice President of Republic National of Dallas

Darrell Hughes Hamric of New York has been elected a vice president of Republic National Bank of Dallas by its board of directors, Fred F. Florence, president, announces. Hamric, formerly an assistant vice president of Bankers Trust Co. of New York will assume his duties as an officer in Republic December 15.

Foster Appointed Vice President Of Foster Wheeler

Pell W. Foster, Jr., vice president and director of Foster Wheeler Corp., has been appointed vice president in charge of production. He has been associated with the company for 27 years, was elected a vice president in 1942, and a member of the board of directors in 1938.

Smith Wichita Falls Representative For Stewart & Stevenson

F. W. Smith, diesel power engineer for Stewart & Stevenson Services, has been appointed sales representative for the company's Wichita Falls office, it is announced by Joe Manning, general manager.

Three Executives Visiting Venezuelan Operations

Herbert Hoover, Jr., president, and E. G. Schimpf, vice president, United Geophysical Co., Inc., and Paul Fitzgerald, Dowell Incorporated, are now in Venezuela visiting oil operations. They expect to return to the United States about December 15.

H. HOOVER, JR.

E. G. SCHIMPF

Peavy Made Southwest Manager for Dresser

E. E. PEAVY

Appointment of Elton E. Peavy as Southwest district manager for sale of products to the oil industry has been announced by H. Z. Hight, sales manager, Dresser Industries, Inc. Peavy will cover the southwest territory including Texas, Louisiana, Oklahoma, Arkansas, Mississippi, and New Mexico. He succeeds H. R. Shidel who will supervise the Houston warehouse which serves the Southwest.

Formica to Open New Factory Sales Office at Dallas

A new factory sales office will be opened in Dallas January 1 by The Formica Insulation Co., Cincinnati, J. Roger White, vice president in charge of sales and advertising has disclosed. New office which will serve the southwestern area adjacent to Dallas will be located at 3606 Commerce Street. Morton F. Harvey, associated with Formica's sales office in Chicago for more than 20 years, has been appointed manager of the Dallas office.

Davison Promoted in Core Laboratories

James A. Lewis, president, Core Laboratories, Inc., has announced the promotion of W. H. Davison to vice president and general manager. Davison, formerly assistant to the president, will continue to maintain his office in Core Lab's main building, Dallas.

W. H. DAVISON

Dawson Managing Director Of Jessop International

H. M. Dawson has been appointed managing director of Jessop Steel International Corp., wholly owned subsidiary of Jessop Steel Co., Washington, Pa., according to Fred T. H. Youngman, president. Dawson's headquarters are in the Evening Post Building, 75 West Street, New York. Jessop Steel International Corp. was formerly known as Jessop Export Sales Corp.

Emsco Announces Staff Promotions

H. H. Glen, president of Emsco Derrick & Equipment Co., announces the following organization staff changes: C. L. Lamkin, vice president, has been moved from the Houston plant, where he served as plant manager, to the main offices at Los Angeles. Paul Courtney, formerly sales manager of the Houston branch, has been appointed manager of the Houston plant to succeed Lamkin. His position as Houston sales manager has been filled by J. T. Tucker, who previously was field service manager in the Mid-Continent area.

H. H. GLEN

C. L. LAMKIN

PAUL COURTNEY

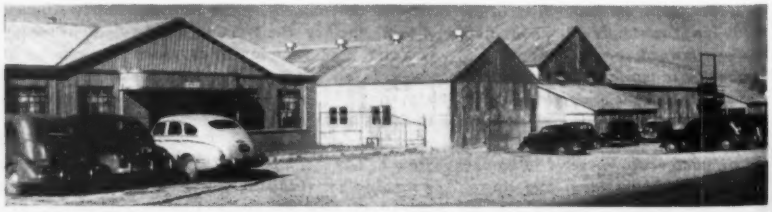
J. T. TUCKER

Porter Moves Pump Manufacturing to Pittsburgh

H. K. Porter Co., Inc., announces that it is moving its two Quimby pump-manufacturing operations in New Jersey to the company's plant at Forty-ninth and Harrison streets, Lawrenceville, Pa.

Rochester Manufacturing Co. to Distribute From Dallas

Rochester Manufacturing Co., Rochester, announces the opening of a Dallas office at 529½ South Ervay. The office will be in charge of Donald C. McNall, sales engineer in the liquefied petroleum gas gage division at Rochester. He will handle all of the company's products which include liquid level, pressure, and temperature gages.



Allied Steel Products Corp.'s new 10-acre plant site at 2110 N. Lewis, Tulsa